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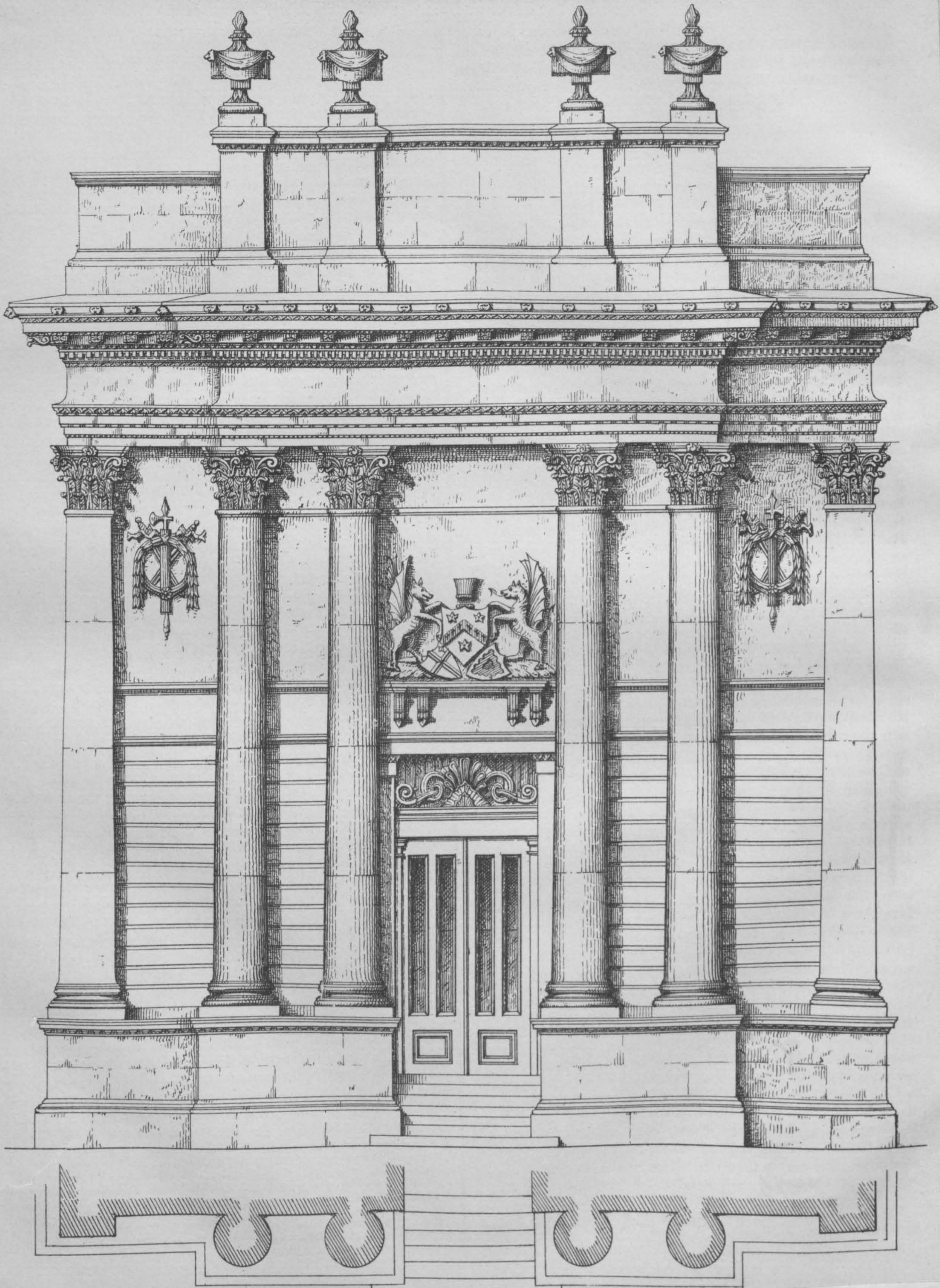

## SOME OBSERVATIONS ON PROPRIETY OF STYLE, PARTICULARLY WITH REFERENCE TO THE MODERN ADAPTATION OF GOTHIC ARCHITECTURE.

By Edward Hall, Architect.

*(Read at the Royal Institute of British Architects, June 26th, 1843.)*

" dead men
" Hang their mute thoughts on the mute walls around."

" Yet to the remnants of thy splendour past,
" Shall pilgrims pensive, but unwearied, throng."

Very few years have elapsed since the style of architecture, called Gothic, was ill-appreciated, or little understood in England.[1] Teeming as our island is in its highways, and its sequested nooks, with mementoes of the piety of past generations—discoursing "sermons in stones" —and breathing, through the interval of centuries, on the chords of present time—the lyre lay long untuned, and gave none but discordant notes. The labours of the honoured few, who alone cherished a love for the architecture of the country, were treated with ridicule and contempt; whilst the student and the man of letters, slighting, or ignorant of what his country contained, sought in Italy, and in Greece, vestiges of the arts and mythology of nations, whose religion was idolatrous, and whose architecture ill consorted with the requirements of a Christian faith. Our cathedrals were repaired with a degree of carelessness, pardonable at no time; and were crowded with screens, and altar-pieces, and with costly monuments, discordant in style as they were tasteless in design and execution. But, happily for the honour of the age, love of antiquarian topics, and of works of art for their intrinsic excellence, have caused a re-birth in architectural history. The wonderful skill in construction, and the taste of our ancestors are appreciated; the remote village church is examined for the beauties which characterize *it*, not less than do fine proportion and elaborate enrichment the *cathedral* and the *college;*—religious feeling assists in the movement, and it is scarcely too much to say, that the time is close at hand, when, for ecclesiastical structures, [1] Gothic architecture will become as much the architecture of the country as during the splendour of the thirteenth and fourteenth centuries.

However, as architects, we may regret the tendency at our universities towards imitation rather than design, it must be allowed, that the attention, paid to Gothic architecture there, has met with good results, in a greater care in the restorations of existing fabrics. The importance, as historical records, which attaches to all architectural remains, renders it a sacred duty in the architect to well inform himself on all features in different styles, so as to transmit to posterity the structures he is called upon to re-instate, with every line and trace of their founders' character and skill. The architecture of Egypt in its paintings and hieroglyphics, in its long and gloomy vistas, and its avenues of sphinxes, is a lasting petrifaction of the manners and customs of the people, and of the dominion of that mysterious hierarchy, who sat in judgment over the dead, and who curbed the flights of imagination in architecture and in sculpture by inviolable regulations. The porticos and sculptures of Greece are living evidences of the refinement of a nation, who responded to the works of its artists, as to the creations of the dramatist, and the reasoning of the philosopher; while the sumptuous edifices of the Romans speak of the pomp of imperial sway and the slavery of subject states. The architecture of every country, and of every age, is vocal with the inmost workings of its creating mind: and it occupies the place of written history in points which, though of the highest interest, historians have for the most part failed to touch. The architecture of the middle ages is not less valuable to the observing student of history, than the architecture of Egypt, of Greece, or of Rome. To the eyes of the general historian and the artist, the majesty and richness of the cathedral tell of the self-sacrificing spirit of our forefathers, who devoted their wealth and their lives to the service of religion. Every village church is a key to the history of the surrounding district;—from its effigies, its sepulchral brasses, and its heraldic enrichments, the topographer and the genealogist may derive important data, for the prosecution of researches into the history of a county, and of its principal inhabitants. The "very age and body of the time" are manifest in each feature, and in the minute details are related even the passions, and the animosities of the different orders of the priesthood. Though sad instances of destruction still occur, though churches still receive their periodical coat of whitewash—until the richest foliage is obscured by the useless repetition [2]—the course of demolition has been reduced; while the restorations in progress, or about to commence, afford matter for the highest gratulation. Thus the architect must combine the pursuits of the antiquary with the study of the practical and the recent; his researches must extend into the curious and the obsolete, to enable him to understand the style and details of any edifice under his care.

It is a matter of surprise to all who study and love the architecture of the country, that its revival for ecclesiastical structures should have met with opposition. This opposition—urged by the highest love of art—has been publicly expressed and published, so that it seemed incumbent on those who desired to walk in the steps of our forefathers, to show that another view of the question was not unsupported by argument. But the matter not having received the notice that might have been expected, I have ventured before you this evening, and if the question suffer in my hands, I beg it may be understood, that arguments are *not* wanting which could have been adduced by those, who might have anticipated me in my present subject.

The opinions referred to may be thus stated. That the "taste of the day inclines to the Roman Catholic plan, suited to a demonstrative form of worship, rather than to the auditorium required by the Protestant ritual," and that "the churches of Sir Christopher Wren are better adapted for models." That proportions in Gothic architecture were "wholly capricious," and "subject to no order or regularity," nor that "any have been ever attributed" to the style by its greatest admirers, so that "columns or supports might be from five to fifty diameters in height, and were only bounded by possibility;" that the delight, confessedly inspired by the works of the middle ages, is to be referred to a "love of the marvellous," which "love of the marvellous is dangerous, exaggeration being the first sign of a mind indifferent to the value and beauty and sufficiency of truth, and the surest sign of depravation of judgment." "The Egyptian, the Roman, and sometimes the Greek indulged in the gigantic, with a view to the expression of a prodigious energy; but the middle ages were prone to the marvellous, surprise was the great scope of the Gothic architect." That "the middle age church was wholly founded on superstitious associations." "The plan described the cross, the universal symbol *in hoc signo vince*." That "the nave represents the body of the saviour; and the side, which 'one of the soldiers pierced,' considered to be the south as the region of the heart, is occupied at Wells by a chantry, at Winchester with the chapel of William of Wyckham, and is constantly the pulpit from which the faithful were reminded 'to look on him whom they have pierced.'" "The choir was inclined to the south, to signify, that 'he bowed his head and gave up the ghost,'" and "there are few cathedrals in which this deflection is not remarkable." "At the head of the cross was the chapel of the Virgin—Jesus resting in the lap of Mary. At the foot, the west-end, was the 'Parvis,' supposed by some to be a corruption of 'Paradis,' that happy station from which the devout might contemplate the glory of the fabric, which was chiefly illustrated in this front, and from whence they might scan the great sculptured picture, the calender for unlearned men, as illustrative of Christian doctrine and the temporal history of the church, under its princes and its pre-

[1] It will be observed, that the subject of propriety of style in domestic architecture is not now entered into.

[2] The whitewashing, colouring and painting of *stone* are species of *monomania* frightfully prevalent. The base of the internal order of St. Paul's Cathedral seems to have been painted not long since, and, being of a bright yellow, contrasts with the older whitewash above. It may be assumed that this is not in accordance with the wish of the present talented architect. Colouring for the purposes of decoration, which requires no renewal, is mostly on flat surfaces, and can spoil no ornaments or mouldings; is unobjectionable, and a valuable means of enrichment.

lates. Three great niches leading into the church, the centre one above forty feet wide, were adorned with the statues of the apostles and holy men, who 'marshal us the way we should go;' in front, the genealogy of Christ, the final judgment, the history of the Patriarchs &c." Further it is said, that "the same want of cultivated judgment, which is apparent in the æsthetical of the arts of the middle ages, is traced also in the imperfection of their statics and stereotomy, in which again solidity is sacrificed to superstition." That as "the figure of the cross" was "indispensable," though "the arches of the nave, formed their abutment abundantly in the western termination, which was commonly fortified by prominent buttresses, no such abutment existed at their eastern termination towards the lofty pillars of the transept." Consequently, that "the smallest failure of foundation or superstructure, threw so much weight against these pillars as to occasion them to bend," and therefore, the weighting of the pillars with a tower or spire being insufficient, "the last disfiguring remedy, the construction of a reversed arch between them, was employed," (vide section of Wells Cathedral.) Further, that we "crudely adopt the niched and canopied architecture of a religion, peopled with images of saints and martyrs, sibyls, angels and holy men, to a Protestant religion, which, admitting none of these, must leave the niches and the canopies *tenantless*, like well-gilt frames adorning an apartment, the pictures being omitted;—the pride and pomp of heraldry, armorial shields and crests, to an age in which chivalry is exploded and quarterings have dwindled to insignificance." That "slighting those excellencies of sculpture, which shed such lustre on the palmy days of Italian art, we oblige our artists to 'copy the obscenities and senseless carvings of barbarous times, simply that we may carry out the imitation of a style in all respects;'" and, finally, that the result of our want of unanimity in style will be the imposition of anachronisms on posterity, and the falsification of the pages of history in its most interesting and characteristic traits.—Any public expression of opinion is liable to opposition, and I may venture to dissent from these views, which I do for the following reasons.—Because the whole character and purpose of Gothic architecture is eminently expressive of the aspirations of a Christian faith. The upward tendency of the lines, and the pyramidal outline of the whole structure, culminating in the spire, draws the mind of the beholder from realities of earth to hopes of heaven. So inherent is the perception of this moral beauty, that a veneration for the forms of Gothic architecture, and a feeling of its propriety for Christian churches, has never been extinct. Contemned by some, as the offspring of a dark and superstitious age—though the same objection would equally obtain against the invention of printing, and that of the compass—surrounded with the enrichments of a foreign style, it *still* appeared in those traditional features to which the affections of the nation fondly clung. The inclosure of the altar by a screen or railing, answering to the rood-screen, is found, along with the oblong plan, and other features of the national architecture, even in the churches of Sir Christopher Wren, while, amidst all the contrivances and adaptations of diminishing arcades, and peristyles, and of obelisks, the form of the spire and pinnacle was preserved. The metropolitan cathedral was constructed on the old model of the cross with ailes, central and western towers. The style of architecture, changed in domestic buildings, was, in its most essential features, unchanged in sacred edifices, whilst the enmity it did receive from the literati of the towns, lessened not its hold upon the people of the country. The early churches, erected at a time when land had not attained its present extraordinary value, had sufficient space allotted them to afford room for interments, and to allow of the position and form which tradition had consecrated. The churches of the city of London, for the most part enclosed on every side, can scarcely be given as examples of the particular form of plan, most likely to have been adopted, had no trammels presented themselves to their builders. Yet in all of them there has been a recollection of the oblong form, suited to the earlier worship; whilst in a very large number the proportion of length to breadth is equal to that of Gothic churches. In *some* of them the foundations of the previous churches were retained; but it is scarcely likely such "economy" would have been practised in that age to the presumed disadvantage of the church in other respects.[3] In the smaller Gothic churches, (*vide* Fig. 1.) the whole length of the nave and chancel is frequently but twice the width of the nave and ailes, so that that part westward of the rood-screen, and in, or immediately adjoining which, all portions of the service, demanding the arrangement of an auditorium, are performed, is of the dimensions retained in those churches of Sir Christopher Wren, which approach nearest to the square form.

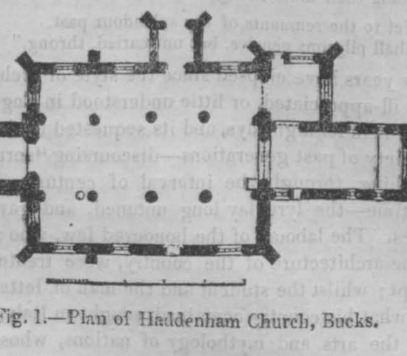

Fig. 1.—Plan of Haddenham Church, Bucks.

That fine effect of length in the nave of the Gothic cathedral, like all beautiful effects in art, is due to an impression, produced upon the mind by skilful proportion and arrangement, rather than to actual dimensions upon the ground plan. The length of the nave is little more than double the breadth of the nave and ailes; while it does not amount to that in some of the finest cathedrals.—So that any opinion that a form, presumed to be better adapted for sight and hearing, was employed, to the exclusion of the established proportions, is scarcely borne out by a careful comparison of different fabrics. The nave of the earlier church will be found better adapted for hearing, than any of those churches which have not borrowed from the Catholic model; whilst the improvements in the internal arrangement of churches now in progress, by altering the size and position of the pulpit, and substituting open benches for pews, will render even an increased length of chancel less objectionable than the old arrangement, in which the cumbrous pulpit and reading-pew prevented all view of the communion. If an auditorium were all that is required for the purposes of religion, the ordinary lecture theatre would present the best form, but one which would excite no emotions of devotion. Were you to transplant one out of the major part of our metropolitan churches to some district "remote from towns," the chances are, that the structure would be called a villa or something else; but if you were to select Bow Church or St. Bride's, there would probably be some suspicion, that you had intended to erect a church. The truly appropriate character seems to reside in that style, which our forefathers adopted, and which is eminently expressive of every Christian's faith.

Since the close of the seventeenth century, when one, possessing the varied endowments of Wren, could style Gothic edifices, "moun-

| | Ft. | In. | | Ft. | In. |
|---|---|---|---|---|---|
| [3] All Hallow's, Bread Street .. .. .. | 72 | 0 | × | 35 | 0 |
| St. Mary, Aldermanbury .. .. .. | 72 | 0 | × | 45 | 0 |
| St. Michael, Cornhill .. .. .. | 87 | 0 | × | 60 | 0 |
| St. Mary's Somerset, Thames Street .. | 83 | 0 | × | 36 | 0 |
| All-Hallow's the Great, Thames Street | 87 | 0 | × | 60 | 0 |
| St. Andrew, Holborn .. .. .. | 105 | 0 | × | 63 | 0 |
| St. Michael, Queenhithe .. .. .. | 71 | 0 | × | 40 | 0 |
| St. Bride, Fleet Street .. .. .. | 99 | 0 | × | 58 | 0 |
| St. Benet's, Gracechurch Street .. .. | 60 | 0 | × | 30 | 0 |
| St. Mary, Aldermary .. .. .. | 100 | 0 | × | 63 | 0 |
| St. Matthew's, Friday Street .. .. | 60 | 0 | × | 33 | 0 |
| St. Stephen's, Wallbrook .. .. | 82 | 6 | × | 59 | 6 |
| St. Edmund the King, Lombard Street | 60 | 0 | × | 39 | 0 |
| St. Olave, Jewry .. .. .. | 78 | 0 | × | 34 | 0 |
| St. Magnus, London Bridge .. .. | 90 | 0 | × | 59 | 0 |
| St. Mildred, Bread Street .. .. .. | 62 | 0 | × | 36 | 0 |

These dimensions are taken from various works of standing—but some vary a few inches from the actual measurement; they are, however, sufficiently near for the present purpose.

tains of stone, vast gigantic buildings, but not worthy the name of architecture," or Evelyn could say "Gothic architecture is a congestion of heavy, dark, melancholy, monkish piles"—vague and inappropriate expressions, bearing as little assimilation to the style as did the attempts of the architect to the churches he reviled:—since the time when Gough and Carter, and other honoured few, alone upheld the merits of our antiquities, how much has the study of our national edifices increased; and from this study, wonderfully systematised within late years, has resulted a high admiration of the old English architects, and of the principles which guided them in their sublime conceptions. Yet, the opinions of the seventeenth and eighteenth centuries have been revived in the nineteenth, and Gothic architecture treated as devoid of sound principles of proportion and taste. Though no Vitruvius of the middle ages has bequeathed to posterity written rules, and though heights and projections be not governed by modules, the opinion has been gradually growing, and has now reached conviction, that principles of design did exist, and that proportions of parts were observed. In the main principles of design, all styles, having claims to rank as beautiful, agree; and in *those* principles the medieval architects were consummate masters. In any style of architecture, whose horizontal and vertical lines are of equal number and prominence, we should not expect to find that beautiful effect, which results from an increased importance being given in one of those positions. Thus, while in the Grecian temple the main lines are horizontal, in the Gothic they are vertical; a like principle being observed in each. So when, during the decline of Gothic architecture, the horizontal line came into increased use, all the richness of ornament—so profusely lavished upon the structures of that age—failed to conceal the original mistake. In attention to pyramidal outline, whether of masses or of parts, the Gothic architects surpassed all rivals. In "unity and sub-division of parts," the groined vaultings and the window tracery of the best period, exemplify those main principles of beauty, which govern the disposition of the members in the Greek entablature—the beams and coffers in Italian ceilings—the cartoons of Raphael, and all beautiful compositions of whatever style and date. The west window of York Cathedral,

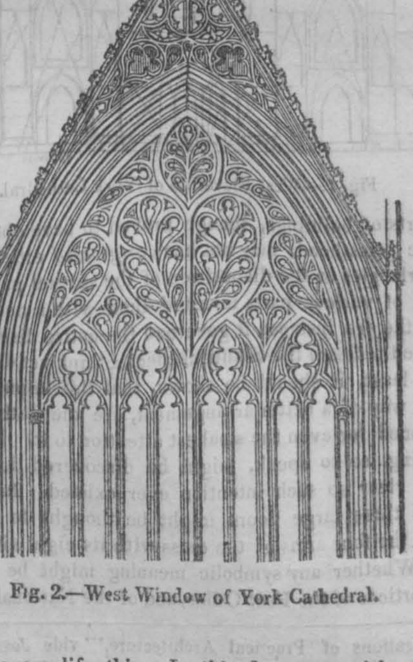

Fig. 2.—West Window of York Cathedral.

(Fig. 2,) will exemplify this. In this fine composition, no effect is improperly lessened by the presence of any neighbouring part. An arch of unornamented but elegant mouldings, placed beneath a rich crocketed canopy, circumscribes tracery of the most elaborate designs. Three mullions, each 11 inches in width and 8 inches in projection, divide the opening into four equal parts; each of these compartments is subdivided by another mullion, which is only 8 inches wide and 6 inches in projection. The ramifications of the head are marked out into large and bold features by the continuation of the larger mullion, from the sides of which spring the mouldings, which form the smaller ramifications. Drawing attention to so celebrated an example, with which all present must be quite familiar, affords me a main link in the chain of argument—indeed proves that the main unvarying laws of composition were known to the Gothic architects as to the great in art of every time.—

> " 'Mid curves that vary in perpetual twine,
> " Truth owns but one direct and perfect line."

This principle of dividing by large features, and subdividing by smaller, being—to use the words of Burke—"as it were, moulded into each other"—has been ably elucidated by Professor Willis in an elaborate paper on Gothic vaultings, published in the transactions of this Institute. It may be difficult to deny, that the principles of pointed design permitted a greater latitude, or, that exceptions to the general arrangement were not unfrequent in a style of such invention and variety; and it is also probable, that in the different lodges of Freemasons, the principles themselves might slightly vary; but to assert, by implication, that the beautiful creations of Gothic architecture are the results of accident rather than design, seems akin (if the comparison can be drawn without offence) to the belief of one, who, in the order and regularity of the universe, can discover no sign of a pervading Mind. The fact that the knowledge of the Freemasons was jealously guarded, is sufficient to account for our not possessing a written explanation of their secrets. Whilst, in one edifice, the proportions are to some extent deficient in elegance, in another we are delighted with their exquisite effect; which shows that they are still matter for study and attention, though they may not square with those of an opposite style. Take the example of an early English doorway of good character: we shall find that the perpendicular lines could not be lengthened or diminished without destroying the effect which its present proportions produce, unless we at the same time make some change in the decorative features. Thus, in the drawing of the doorway, Fig. 3, from Rothwell Church, Northamptonshire,

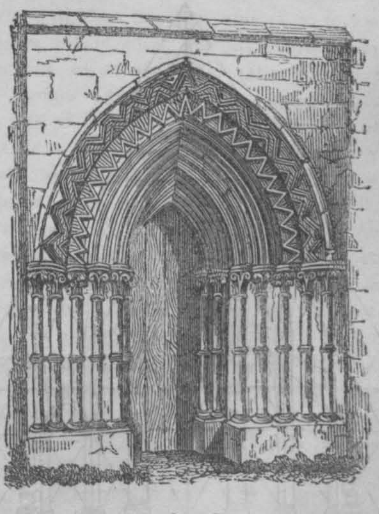

Fig. 3.—Doorway from Rothwell Church.

the opening is much narrower in proportion to its height than we generally find it in other doorways of the same date; but the effect of the *whole composition* is not lessened, for the increased width is gained by the columns and decorations, and in appearance, by the horizontal line which runs across the composition in the shape of bands to the shafts. Yet, it seems to have escaped the attention of many detractors from the merits of pointed architecture, that it is possible, under different circumstances, to attain the same end by different means. As in Italian design—an arched doorway of two squares and a half in height, Fig. 4, would probably appear too lofty, if decocorated with a simple architrave, but, if a cone with panels be inserted, Fig. 5, the eye is at once reconciled to the proportion. Mr. Hawkins, in his "History of the origin and establishment of Gothic architecture," says that in the year 1321, several persons (whose names he gives) who were appointed to examine the works at Sienna Cathedral, declared that the works ought not to be proceeded with, as the established proportions of the old church would be destroyed, and it would not have that measure in length, breadth and height, which the rules for proportioning a church require. Had there been no settled rules of proportion, it is clear, that the architect could not have transgressed.

Fig. 4.

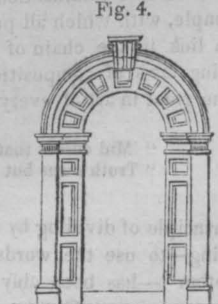

Fig. 5.

But the elucidation of a system, which might have been employed by the old architects, in proportioning the parts of buildings, has been attempted by Mr. Billings, and, as regards Carlisle and Worcester Cathedrals, with success. The same subject has also occupied the attention of the Oxford antiquaries. I am also disposed to give a higher rank than that of superstition to the system of proportion in which triangles were employed, first noticed by Cesare Cesariano, Fig. 6, [4] and illustrated by D'Agincourt, in his elaborate work, entitled "*Histoire de l'Art par les Monumens,*" in the sections of Milan and Bologna Cathedrals. The objections brought against this system appear to have resulted from an inaccuracy in the description and diagrams of Cesariano. In Fig. 6 the triangles are all *equilateral,* and their lines intersect parts of the building in such a manner as to lead to the belief, that *they* actually determined the proportion; thus symbolic of

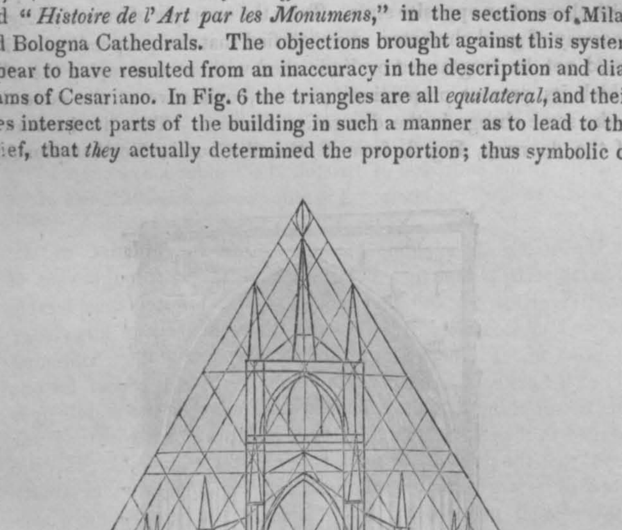

Fig. 6.—Cathedral of Milan—Cesariano's Theory.

[4] The translation of Vitruvius by Cesariano is a scarce work;—the illustration given is from Hawkins' Gothic Architecture.

the Trinity. But it may be asked, whether any cathedral constructed on sound principles might not have the same proportions, as to width of nave and ailes, as the one under notice, and if so, whether the use of equilateral triangles might not give the most effective arrangement. But, omitting this view, the opinions as to the "superstitious" origin of Gothic proportions, are founded, not on careful measurements, but on the obscure text and rough diagrams of Cesariano, which vary so much from the actual dimensions, as to give the total height of the spire one third less, than as at present existing. The triangle is of the greatest service in proportioning the parts of buildings, in accordance with that pyramidal character which should pervade every building of whatever style, and seems to have been *so* used by the Gothic architects. In a late work by Mr. Bartholomew it is shown that the pyramid or triangle may have governed the proportions of the west front of St. Paul's Cathedral; [5] and a similar method was probably practised by the earlier companions of the order, to which Wren belonged. Its application to the west front of York Cathedral I have endeavoured to show in the diagram, Fig. 7. That peculiarity of symbolising the

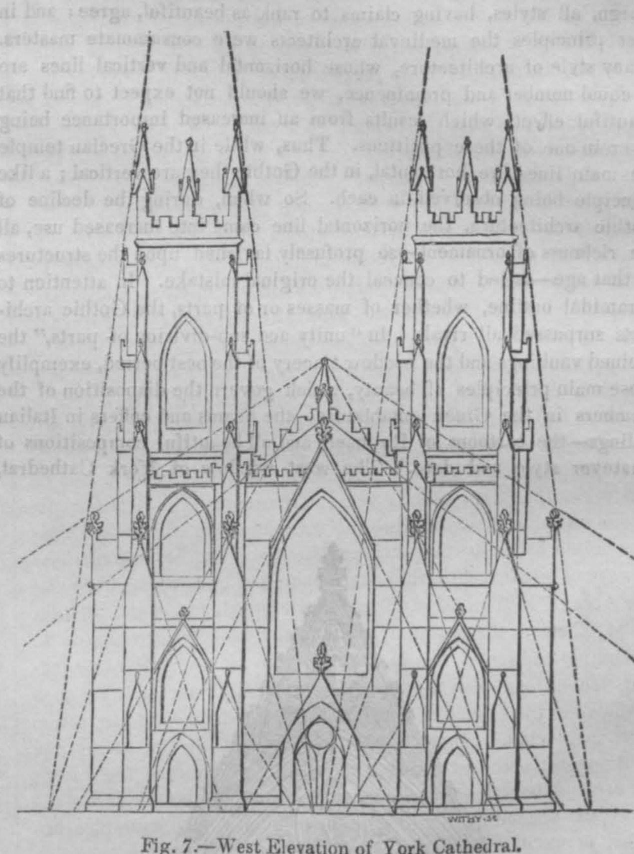

Fig. 7.—West Elevation of York Cathedral.

different parts of buildings, though proved to have obtained amongst the Catholic priesthood, may not have *originated* either the proportioning by triangles or the disposition of the several parts. The after symbolising of various parts invested them with a peculiar sanctity; but that, in the *first* instance it governed the entire disposition, or that it ever tended to *lessen* the beautiful effect, I think yet demands further proof. At least, it should be shown, that this imputed symbolism stood in the way of a better arrangement, ere the Catholic architects are condemned for even the smallest attention to it. Indeed, a symbolic meaning, so to speak, might be discovered in buildings, in which it is clear no such intention ever existed. In St. Paul's Cathedral, the three large doors might be thought to symbolise the Trinity, and the four arms of the cross with its eight ailes, the twelve Apostles. Whether any symbolic meaning might be discovered in the three porticos of the Post Office, and of the National Gallery, or in

[5] "Specifications of Practical Architecture," vide *Journal,* Vol. III., p. 329.

the common street elevation of a door and window on each side, it is perhaps not safe to say; but the mere facility with such coincidences may be made to appear in all buildings, and in particular the constant and necessary combination of *three* objects, shows the necessity of extreme caution in speculating upon the subject. A writer in the *Gentleman's Magazine* well remarks, that those parts to which symbolism has been most commonly applied, are deficient in the most essential requisites, as the three divisions of the nave, and of the triple lancet, are in co-equality. That, so great a variety of rules, have been at different times, given for proportioning the parts of edifices, all nevertheless agreeing in the results, goes to prove that the particular system to be adopted is of less importance, than the use of some SYSTEM, from which may result that veiled grace, always delighting the mental vision in a structure projected by symmetrical rules. Such rules the Gothic architects are proved to have observed.—It is said that "columns or supports might be any number of diameters in height, and were only bounded by possibility." Let us admit this, and examine what practice has been pursued in other styles. By the elaborate experiments of Mr. Eaton Hodgkinson, on the powers of resistance of different bodies to compression, it has been proved, that in cylindrical forms, there is a certain proportion of height to diameter, beyond which it would be dangerous to go, the resistance rapidly lessening in proportion with the height. To pass that limit would endanger the stability of the fabric; to keep much below it would be a needless expenditure of material. From a non-observance of this propriety, we have frequently seen columns of harder material of the precise dimensions given to those of stone. Now such a practice is foreign to the principles of Gothic architects, as may be seen by the most casual comparison of their works in wood, stone, and metal; in which they had reference to the properties of each. The rules of classical architecture require, that no alterations should be made in the proportions of columns which are engaged, coupled or clustered, though it is clear, that, in accordance with the principle hinted at above, and a feeling, which, without reference to the results of experiment, exists in every mind, the same proportions should not be observed. At least, the Gothic architects pursued a different mode, on sounder views than have usually been attributed to them. Their circular columns, placed singly, were shorter than those which were clustered or united as shafts to piers and arches. Further, when these shafts were of great length, they were encircled by bands as at Westminster Abbey. In the Ladye Chapel at Hereford, and in the Chapter House at Chester, the isolated shafts to the windows are banded to the adjoining mullion by ties of stone, which are converted into features of decoration. But the absolute constructive necessity for such ties is shown in the failure of slender shafts, in which such precaution has been neglected. Shafts without bands, and at the same time of great length, occur at Salisbury Cathedral; while in the Ladye Chapel are isolated shafts, supporting the roof, of the slenderest dimensions, and uncombined with a larger column. Such examples are extremes, or exceptions to the usual practice, and though as in this wonderful edifice, calling forth our admiration and delight, they are not what the modern architect would emulate. I venture to assert, that we are justified in craving of those, who deny the existence of principles and proportion in Gothic design, that they should compare the cathedral, the abbey church, the parish church, and the collegiate chapel, marked each by clear and distinctive lineaments; that they should closely scrutinise and balance every minute part of a composition; that they should examine whether the different tendency or number of lines, the different character or quantity of ornament, or some other cause or influence, has not dictated a manner of treatment varying from that they have observed in another composition, but in strict accordance with the same first and inviolable principles of both; or whether the example is not such an exception to the usual style and principles, as all ages have witnessed. Our delight in Gothic architecture is indeed the result of elegant outline and proportion, richness of detail, sincerity and scientific construction, along with admiration of the high purpose and untiring labour of the architect, rather than of a "love of the marvellous," or mere respect for what is old. The "love of the marvellous," of which the Gothic architects are accused, was seen in the "large stones" of the Grecian temples, the columns of one block of the temple of Diana at Ephesus, in the temple of Jupiter at Agrigentum, in the costly structures of Baalbec and Palmyra, in the Colosseum, in the domes of St. Peter's at Rome, and Sta. Maria at Florence, and in the gigantic order and all the conceptions of Michael Angelo. "Another enemy to the beautiful, and even to the sublime," says Forsyth, "was that colossal taste which arose in the empire and gave an unnatural expansion to all the works of art." As it is beyond the power of man to create a style, all styles being the work of ages and of circumstances, rather than of architects, who should be able to infuse new beauties into all, and as, in the words of Reynolds, "it is vain to endeavour to invent without materials on which the mind may work, and from which invention must originate;" are these the styles for which we must close our eyes to the expressive architecture of our own land? Is there any distinction between the end sought in the colossal works of the Egyptians, the Greeks, and the Romans, and that "love of the marvellous" ascribed to the Gothic architects? or is not the raising of surprise a legitimate end of all architectural skill? I cannot think that the plan of the middle age church was wholly founded on *superstitious* associations, and that the spire and cross are not appropriate emblems of both the Catholic and the Protestant faith. From the plan of the cross result the most beautiful outline, both externally and internally, and the most captivating effects of light and shade. It is not exclusively Gothic; and no higher testimony to its merits could be gained, than its adoption by so great an artist as Sir Christopher Wren. The majority of the English churches are not cruciform, which is sufficient to show the form was not indispensable. That some particular sanctity was attached to one side of the nave in cathedrals, may be inferred from the fact that in the majority, the monuments on the southern side and in the southern aile preponderate. But it should at the same time be noted, that in several examples the monuments on the north side are equal in number, or nearly so; and, that at Wells, when there is a chantry under one of the southern arches, a corresponding position is similarly occupied on the north side. As regards the inclination of the choir to the south, I believe no perceptible inclination occurs in the *English* cathedrals; and at Litchfield, where an inclination to the *north* is discoverable by measurement, the variation is so slight, that I think few persons would discover it within the building. The ladye chapel, though generally at the west end of the choir, and certainly so placed with fine effect, is not unfrequently elsewhere. In the cathedral of Bristol, the "elder ladye chapel" is at the north side of the choir. A similar position is made use of at Ely.

But the strongest objection brought against the practice of the Gothic architects, is that their buildings have failed through want of constructive principle; and that though they manifested considerable enterprise and dexterity, they lacked that theoretical knowledge which grew under a better order of society, and "the chastening counsel of a Locke, a Newton and a Bacon." Now it cannot for one moment be supposed that the scientific knowledge of the middle ages approached to the learning of a Galileo, a Napier, or a Newton; nor be denied that the mass of the people were utterly ignorant. But the existence of a large number of mendicant friars, always at enmity with the regular priesthood, yet as ignorant as those upon whose fears they lived, seems to have led to the general belief, that all the Catholic clergy had little in their heads but a knowledge of bad Latin; or in their libraries, except the writings of the fathers. But, amongst the churchmen was preserved all the knowledge of the age; they directed the architectural works and the engines of the state; and though their projects were often carried out by less skilful hands, their expressed intentions bear the evidence of a knowledge of practical mechanics, of the composition and resolution of forces, which, it is difficult to conceive, could rest on any other than a foundation of geometry. Mere solidity is often best obtained in buildings, in which but little science is called into play; but with a greater expense of material and labour, and less scope for decoration and convenience.

be made out with marvellous care, he will yet turn to those monu-Small scientific skill was required for the construction of the Druidical temple, or the Grecian portico; but from the increased use of the arch arose a new era in the art of building. Smaller stones were employed, with skilful arrangement of counterfort; and labour replaced by economy and facility of execution. With the change from the semicircular to the pointed arch, arose a still greater facility of execution, combined with a nearer approach to the advantages which had resulted from the principle of simple repose. But along with, though not necessarily resulting from the use of the pointed arch, a force was at work towards the ruin of many edifices, but for which the practice, rather than the theory of Gothic architects must be censured. The supporting columns of the central tower began to bend in the middle, as at Westminster; and other failures, all proceeding from one cause, took place little subsequent to the building of the several structures. It became necessary to connect the great piers of the tower, to prevent the recurrence; and counterforts were inserted at Salisbury, Wells, (Fig. 8,) and elsewhere. It has been thought that this failure of

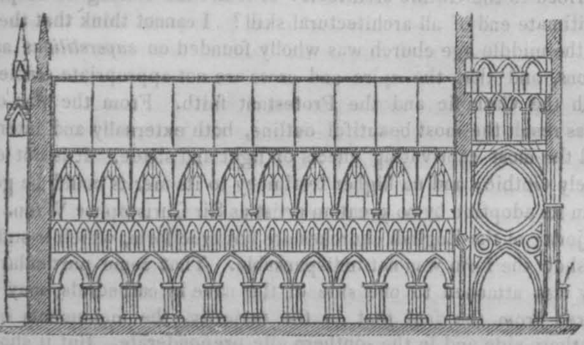

Fig. 8.—Section of Wells Cathedral, looking north.

the central piers was occasioned by their insufficiency as abutments to the adjoining arches; and this opinion seems to have been present with Sir Christopher Wren, in his proposal to add a central spire to the abbey. But I am inclined to think, that the breadth of the piers, coupled with the weight of the tower above, would be well able to resist the thrust of a *pointed* arch, were not some other tendency at work; and prefer the opinion, that the bending of each column was wholly caused by the sliding of the rubble work upon the back of its neighbouring arch. The more pointed the arch, the less thrust would it exercise, but the more would it tend towards the settlement. This seems a more probable cause than any other; there could have been no objection to increasing the dimensions of the column if necessary. The report on the state of Hereford Cathedral shows that this sliding of the materials upon the main arch of the tower, assisted by the subsidence of the foundation, has caused its western column to swerve from the perpendicular, and in the opposite direction, that is, towards the west.[6] The same thing has taken place at Aylesbury Church, in a like direction; and the displacement of the ashlering in the tower of St. Mary's, Redcliffe, was attributed, by Mr. Hosking, to the subsidence of the rubble work. Had the spandrils of the arches been laid in courses, which modern experience would dictate, such failures could not have occurred, and therefore no objection can be taken to the modern adaptation of Gothic architecture on the ground of insecurity. It may be remarked that there is some difference of opinion about the reversed arch at Wells—as to its merits as a composition.[7]

Though in "these piping times of peace," "armorial bearings" no longer distinguish the warrior on the field, they are still not exploded, nor have they ever been in any country; they still engage the patient attention of numerous antiquarians, and seem to be a legitimate mode of decoration in any style of architecture. One of those recollections of the past, which are stable, though the occasion has past away, they will yet long serve to shorten the labours of the historian, as now.—The so called economy of modern times has deprived our art of that sister, without which she is inexpressive, and incomplete; but there can be no other reason that niches should be "tenantless" in any religious edifice: and none that the *obscenities* of former times should be copied in the present. The exquisite richness of the Gothic foliage would be apt, from its very profusion, to cloy upon the mental palate, had it no immediate contrast, as with the grotesque and the satirical. Thus, as at York, we find the passions of men and the habits of animals depicted amongst the leaves of a capital or a bracket. In other cases we have the monogram IHS and other religious insignia. Though some of the carvings are sufficiently shocking to eyes polite, as for example, the gorgeuils, yet these are never "senseless;" they have always an expression in character with their purpose, and may safely be contrasted with the unnatural lions, the sphinxes, and chimæras of other schools of art. Though, in the sculpture of the earlier styles, forms were conventional, and a particular sentiment was expressed in an established mode, this severe style presents many claims to our admiration, though in execution, it can be as little compared with the later style, as can the marbles of Xanthus with those of the Parthenon. But good sculpture, and by Gothic architects, does exist, grand in conception as that at Wells, and perfect in execution as that at Westminster; and it received the admiration of our own Flaxman. Speaking of the interior of Henry VII's chapel, he says, "the figures of the tomb have a better proportion and drawing in the naked than those of the chapel; but the figures of the chapel are very superior in natural simplicity, and grandeur of character and drapery." But, of the sculpture of Henry V's chantry, the work of a century previous, he says, "The sculpture is bold and characteristic; the equestrian group is furious and warlike; the standing figures have a natural sentiment in their actions, and simple grandeur in their draperies, such as we admire in the paintings of Raphael." Could there be higher praise than this from so great a man? The vertical character of Gothic architecture does indeed demand in the garments, folds which may accord with the genius of the style; or rather eschews those contortions of drapery and whimsicalities of design observable in the works of the later Italian school, particularly of the followers of Bernini; and of which some idea may be gained from the engravings to the English edition of Palladio's works. If a group be viewed singly in a gallery or an apartment, where only *it* appeals to the eye, its forms may be influenced by the taste of the artist alone; but, in architectonic sculpture, a different treatment of the subject is demanded. A greater rigidity, or a more erect position seems necessary for statues, when combined with architecture, in all styles. "Their attitudes," says Chambers, "must be upright, or, if anything, bending a little forwards, but never inclined to either side. Their legs must be close to each other, and their draperies close to their bodies; for whenever they stand stradling with bodies tortured into a variety of bends, and draperies waving in the wind, as those placed on the colonnades of St. Peter's, they have a most disagreeable effect, especially at a distance; from whence they appear like lumps of unformed materials, ready to drop upon the heads of passengers." That excellence of imitation is not the highest quality of art, is readily granted, but it is not less true, that in some degree it may detract from our delight, by its very excess "reminding us that life and animation are wanting," and thus defeating the aim of the artist. For remarks on this head, vide Reynolds *passim*, in the lectures of the professor of painting at the Royal Academy, and in Mr. Eastlake's translation of Kugler's Handbook.—To him, who feels that a devotional character should be impressed on all monuments erected in churches, I suggest in favour of Gothic architects one practical argument—a walk through Westminster Abbey. There he will find architectural ornaments ruthlessly sacrificed, that square patches of black and white may occupy their place. He will see cumbrous monuments to some "periwig-pated fellow," or some courtier of a passing day, occupying a position, tardily granted or denied, to the mementoes of the philosopher and the poet. But though each individual hair of their wigs or their whiskers

[6] Journal, Vol. V., p. 374.

[7] The counterfort at Wells was probably coeval wit the piers—that at Salisbury later in date.

mental effigies, recumbent in unbroken sleep, or with hands clasped in holy aspiration; and, overcome by the spirit of the place, he will walk with softer tread, his mind impressed with feelings of devotion, and with vivid recollections of his country's great.

In Gothic buildings, no construction is masked by decoration; no sham feature inserted to correspond with another that is real. Sincerity is the guiding rule, and geometry the instrument. In vaultings, the thrust of the main supporting ribs is concentrated at one point, and there counter-abutted by a flying buttress, in the precise direction which the composition of the forces dictates. Bridged across the nave, it was further resisted by the wall buttress, and confined within narrow limits by the downward pressure of a pinnacle, until it found its limit in the earth. Now in this system of counterfort, (the principle of which it was hardly necessary to explain here,) we discover an adaptation of means to an end, surpassed *only* in the construction and action of the human frame. Thus, like the trellis on which the jasmine and the convolvulus entwine, the forms of pointed architecture are but the framework on which beauties are engrafted, evolving those beauties, but never sacrificing themselves to them, and even snatching peculiar graces from circumstances originally adverse. Gothic structures never disappoint, as almost every other edifice is sure to do. The first sight of the church, "bosomed high in tufted trees," the nearer approach, or the study of days, are alike pregnant with delight. The most skilful arrangements of contrast are displayed—in the low doors by which you enter the lofty pile; and in the spires which rise in every part of a level district. Also the contrast of dark to light, in such situations as the porch of Henry VII's chapel.

Whatever objections there may be to the practice of the medieval architects, these can have no hold against a modern adaptation of their style. We should work with all the skill derived from examination of Gothic edifices, and from analysis of the causes of failure in some, superadded to all the advantages which modern discovery affords. We should choose good stone, and select or prepare good foundations, protecting our buildings from damp and decay by drains and water pipes in place of the old gorgueils. And the result of our study of each form of ecclesiastical structure, combined with our invention, would be the raising of fabrics worthy and characteristic of the age, which the peasant and the peer alike would recognise, as expressive of religious uses.

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## THE CAUSES WHICH HAVE ENNOBLED ARCHITECTURE.

By Frederick Lush, Associate of the Institute of British Architects.

*(Continued from page 154.)*

"If to do were as easy as to know what 'twere good to do, chapels had been churches, and poor men's cottages, princes' palaces."—Shakspeare.

It is not surprizing that the great churches of Europe, but especially those on the Continent, should so frequently present a confusion and discordance in their parts, when they were the production of many ages, against the revolutions of which they had to contend, and when, moreover, their construction was committed to many different minds, who it appears very obstinately differed from each other with respect to their architectural principles. However beautiful these varieties of style may be in the abstract, we like to see the same character, the same feeling and expression running throughout the whole, as if one mind alone presided over it. But it seems as if many architects loved to show their predilection for some particular school when called upon to restore or add to any existing edifice, and to act entirely as their own tastes and their own prejudices dictated, without reference to what their predecessors had done, in order to make their work of a piece with them. It is, perhaps, one of the weaknesses peculiar to genius. We think, for instance, of the Corinthian portico of Inigo Jones on the west front of old St. Paul's; and not only what this celebrated man, but many others have done, in their fondness for the ancient or their love of novelty, by introducing something from *Vignola* or something from the *Renaissance* on such noble monuments as those of Nôtre Dame, and St. Germain l'Auxerrois at Paris. It is in consequence of this, that all which is most beautiful in the Gothic in the best ages of its invention, lies scattered over those countries where a passion for it was most felt, and where it naturally best flourished; and it is necessary to accumulate and combine these in order to form a perfect cathedral.

For the finest remains of this sublime art we look to the churches of the 13th and 14th centuries; and although there is scarcely any country which does not claim it as its own, yet we select those of Germany, as this seems the soil from which originally it sprung and was matured; and as in the year 1277, when the famous Strasbourg pile was commenced, there was established in that town perhaps one of the oldest associations of masons, which is the chief lodge, and who have the honour of having built, not only this, but Cologne, and many other edifices, of which the Germans have reason to be proud. That they were not wanting in talent and perseverance for bringing to perfection the style of building of which they were the professed masters and had devoted themselves to, we have abundant proofs; great improvement was necessarily made in it; miscalculations on the composition and resolution of forces were corrected; no defects in their designs were permitted eternally to remain for want of previously studying their effects upon the eye; and every thing was done both theoretically and practically, to place the art on a firm and solid basis. We say the chief aim of art consists in producing the grandest effects with the smallest means; in giving to a structure the greatest strength with the least material; in constructing it in a manner the most advantageous for the purpose to which it is destined, and wherever no ignorance can be detected in *displaying* the art by which all these ends are accomplished. We turn, then, to the works of these builders, and find they did not live to pile up stones in vain, but attained these results with a most unrivalled success.

Their union, moreover, with a number of similar societies, all attached to and teaching the same principles, placed within their reach immense power and immense resources. One of the opportunities that was afforded them of the certainty of the correctness of these principles, was the wide field of observation that was opened to them by means of travelling. By the numbers likewise of the workmen they had at their command, the wages with which they rewarded their labours, and the industry that they excited among them, an employment was created which very much conduced to the happiness and well-being of the poorer class of people. But the good did not cease here. Men were everywhere occupied in erecting a church on a scale commensurate with the imposing rites of the Catholic worship. Superstition, too, in those ages, doubtless had no small share in producing the magnificent structures which were the wonder of the multitude; but we cannot blame them for this. It is not difficult to trace the weakness of our nature in everything, and to see it mingling even in what is most holy. At a period, therefore, less enlightened than our own, we cannot wonder if the hand should be somewhat prompted by superstition in rearing one of those beautiful and elaborate spires which rise above our houses and ornament our land. But if we feel it a kind of devotion to look upon it; if we endeavour when gazing upon it to

"——— withdraw our minds
From earth, and control our thoughts 'till we have
Got by heart its eloquent proportions:"

let us not say that those who reared it were degraded by any such motive; but rather imitate their zeal and rival those efforts of human skill and piety; though their authors were once turned into ridicule by the common people, and thought no better than fanatics. It was this class of persons whose co-operations were the means of ennobling architecture during the middle ages; for whom no art could be too refined, as no religion too sublime. They considered it impossible to conceive any building too grand or too splendid in which to celebrate its solemnities; they wished to make it resplendent with the inventive genius of the pencil; and if they could not possess the frescos of such artists as Raphael and Michael Angelo, those champions of the Christian art, at least to cover its walls with painting and sculpture, as we see in many old Gothic churches of the north, on which some of the pictorial splendour of Italy and the warm countries seem to shine; and on whose lofty ailes and carved pavement, the sun, through the diapered windows, sheds its gorgeous colouring.

Such an edifice as that of which Steinbach was the architect-in-chief, the glory of whose construction none but the ignorant would gainsay, was a powerful motive to induce the inhabitants of other cities who could not boast of such a monument, to build such another; that at least they might not be thought wanting in zeal for, or behindhand in thus making a proclamation of, the new faith which at that time was spreading itself through all Christendom. Accordingly we find a striking similarity among all the great churches of the 13th and 14th centuries, and a conformity in their plan, arrangement, and decoration, which leads us to believe, beyond a doubt, that no other form was so well suited to the mode of worship, both in these and subsequent periods; and that it proceeded from some regular society, such as the freemasons, whose principles were the same, and for a time, universal. The disposition of these cruciform churches, sometimes without, but more generally with, a range of side chapels, corresponding with the division of the side ailes, was, from the time of Constantine, more or less imitated by all civilized Europe; and there needs not a stronger argument in their favour, than in the difficulty that was experienced whenever an attempt was made to improve upon it. Abolish it, and with it we abolish the ceremonies of the religion for which it is intended. But this is not all. A departure from the system exhibited in these ecclesiastical buildings, has been attended with the most dangerous consequences to art. It has been the ambition of all nations, who have excelled in architecture, and been masters of its true principles, to exhibit them, even to an ostentatious degree, in their proudest fabrics. Such a display of science commands attention, though it might be said it was done for mere love of glory; and this was particularly the case in the works we are considering. Now the moderns are too apt to do just the contrary; to disguise the construction of their edifices, that is to say, such churches as those which are unworthy of the name, and whose construction, from the sordid and unscientific means employed upon them, it was wisest to conceal. But can anything be conceived more degrading to art; and is it not to such causes we owe many failures that have occurred in modern church-architecture? The architects of any one of the splendid churches alluded to, would not have been guilty of anything so mean. They felt it was one of the requisites of art to exhibit undisguised the great triumphs which the mind had made in it; and to raise pleasure, or excite emulation, in the souls of all those who contemplated such a production of human wisdom. It might appear strange, therefore, that Wren and Jones, both of whom were at the head of such an institution, so little understood or appreciated that Gothic, which was once such a favourite among its members. But the cause will be easily explained, if we consider it was the fate of this noble art to decline after it had reached its meridian point; that a hankering after something new and uncommon hastened its downfall; and that its beautiful proportions and details became obsolete when the taste for the architecture of the Greeks and Romans naturally brought on the revival of classic antiquity. [1]

The same uniformity of character, mentioned above, may be observed in public works of a civil kind, such as the castles and bridges. The former were absolutely necessary at a time when wars were frequent; and the latter afforded such security to travellers, who might otherwise be exposed to pirates on the river, that the building of them was considered an act of charity; and those to whom they were entrusted were styled *fratres pontifes*. [2] It appears they constructed a great number in Italy and in the southern provinces of France; and the remains of these old bridges and chateaux, are often so picturesque, that it is worth while to undertake a journey on purpose to see and study them.

Now it will not be denied that architecture owes much to the existence of such fraternities; especially during the middle ages, when they were like so many learned republics; when kings and nobles were proud to take a part in their proceedings and assist in promoting their enterprizes. There is no period of history in which we do not find men associating together when bent upon accomplishing any object to which individual exertions were, of course, unequal. The ancients could never have succeeded in their temples, their roads, their thermæs or their aqueducts, had they not condemned their slaves, and all whom they had conquered, to labour on these great works. The population and industry of one single kingdom were not sufficient. Nearly all Asia, for instance, contributed to the building of the famous Diana of Ephesus: and one of those prodigious stones in the pyramids, which almost alarms the inhabitants of the north, must have required in placing it just in its proper place, or even in managing the engine by which it was raised, double and treble the number of labourers which we usually employ on one of our public edifices. In more recent times it was the custom, when a palace, a castle, or a church was in progress, and workmen were scarce, to authorize officers to collect them wherever they might be found, in the same way as they *press* men for the militia, and detain them in the king's service, as it was called, until the works were completed.

A powerful means of ennobling architecture, as well as any pursuit on which the human mind may be engaged, is found in this principle of concentration. The idea of bringing together the fruits of the industry of past ages, naturally originates among all civilized societies. We look in all flourishing cities for those academies for the arts, those museums, and schools of design, which are among the happiest evidences of the power and well-directed wealth of a nation, and without which the arts would make but a very poor and feeble progress towards perfection. We recognize this principle, moreover, in those encyclopædias of knowledge, whose treasures enrich the libraries of Europe, and which are as indispensable to the man of letters as the collected remains of Greek art are to the sculptor; nor do we hesitate in classing the founders of such works and such repositories among the benefactors of our race. For what would be the condition of the fine arts or of the human mind if London were without its British Museum and Royal Academy; Paris without the Louvre and Ecole des Beaux Arts; or Italy without its Vatican?

*(To be continued.)*

## THE BRITISH MUSEUM.

Public attention is so engrossed by matters connected with the new "Palace at Westminster," or by other schemes of improvement for the metropolis, that no one seems now to take any interest in—to care for, or even to remember the British Museum, just as if it were of no importance whatever. This indifference may probably be owing to all hope having been long ago abandoned, of that structure being rendered a worthy piece of monumental architecture; for as far as it is built at present, its exterior is a perfect nullity. Still, even at this "eleventh hour," there is opportunity for redeeming its character, by making something satisfactory of the façade which has to be added, and will now be commenced, we presume, at no very distant time. For what remains to be done, however, that which actually has been done is so very insufficient a pledge, that it is to be hoped we shall be afforded the means of quieting our misgivings, and ascertaining beforehand what we are to expect. Some, or rather now many years ago, Sir Robert Peel declared in Parliament, that the design for the front of the British Museum was an architectural *chef d'œuvre*: we had our doubts at the time, and so far from being dissipated, they are now stronger than ever;—or to speak out more plainly, we have very

[1] See Ducange's "Glossarium," and Bishop Gregory's account of them.

[2] Here, however, I recollect I am not doing Wren justice, for notwithstanding the passion for the antique, which prevailed in his time, he proposed the erection of a cathedral in the Gothic style, the original drawings of which are at Oxford. Perhaps he was the only man who conceived at that period such a design. Every one knows his admiration of the construction of the roof of King's College Chapel.

little doubt at all—on the contrary, feel most uncomfortable assurance of our worst apprehensions being realized, unless some stir be made in the matter.

Sir Robert Smirke himself may be just as admirable an architect as ever he was; yet a change there may be, if not in him, in others: the public have obtained some little more insight into architecture than they possessed ten or twelve years ago, and what they would then have thought very fine, they may now consider no more than barely tolerable. The coming before or the coming after the new Houses of Parliament, which ten years ago were not even so much as dreamt of, makes a prodigious difference; and not they alone, but many other things have come up in the interim, which are likely to take architectural precedence of the Museum.

As the intended façade has been so very long delayed, it is to be hoped that it will not now be hurried after all, but be delayed a little longer until the public shall have been informed what the design really is. Why should there be so much silence and secresy in regard to it? for if the making the inquiry we here recommend, would seem to imply want of confidence in the architect's taste and ability, the extreme reserve shown on his part, and that of those who are more immediately concerned in the matter, equally implies very great mistrust in the design, and strong suspicion that it will not bear the test of much examination. It therefore *looks* as if it were intended to adopt the safer and more convenient course of evading public opinion until it can interfere to no purpose, but merely express itself in *post facto* grumblings. Let us not have another egregious instance of architectural smuggling as to public buildings erected at the public cost: there are by far too many such already; and the National Gallery alone might operate as a corrective warning—certainly should serve as one to the architect of the British Museum.

The façade for the Museum still affords, as we have already observed, an opportunity for a fine display of architecture, but whether the opportunity will be fully turned to account, is what we must wait to find out, when it will perhaps be discovered that comparatively nothing has been made of it. Let us *suppose*, however, that the design is one of surpassing beauty: why then, we ask, should Sir Robert, merely for the sake of taking the public by surprise, have defrauded himself in the meanwhile of all the credit to be derived from it, and which he might have begun to enjoy very long ago? Had the same system of close secresy been observed with regard to the Houses of Parliament, Mr. Barry would not be altogether quite so celebrated at present as he actually is. Of his edifice, we are permitted in manner to enjoy the beauties by anticipation, and to applaud the magnificence of the Victoria tower, that *is to be*. But in regard to the *is-to-be* façade of the British Museum, nothing is suffered to transpire, nor is curiosity allowed to be gratified. The only positive information relative to it, afforded at present, is that furnished by a ground-plan, published in a parliamentary report of 1838. From that, we perceive that the main building will have a continued colonnade in front, not extended in a single line from end to end, as in the façade of the museum at Berlin, but breaking round the advanced extremities or wings, and forming in the recessed portion of the plan between them, an octastyle, advanced one intercolumn, by an additional line of columns in that part. So far, there will, no doubt, be considerable richness and play in regard to columniation, and in that respect we shall get a step farther than we have yet done in the Anglo-Grecian architecture of our metropolis. Yet as provision seems to be made for something more classical, all the more desirable is it that the most should now be made of it, and that the idea should be perfectly wrought up; otherwise the disappointment felt at perceiving how greatly the whole falls short of what it will seem to have been intended to be, will even convert the satisfaction derived from its good points into vexation. The promise made by the plan, may be totally frustrated by the elevation; and such will certainly be the case, should there, after all, be nothing more to admire in the design than the circumstances indicated in the former. If we are to look to the inner court as affording a specimen of what the external order is to be, we feel no eagerness at all to see the façade erected, nor even care if we ever behold it, since unless greatly better than that, the order will be exceedingly unsatisfactory in character, and will prove all the more so, because its tameness and dryness will be all the more offensive, in consequence of the greater pretension made by the *columniation* itself. Something more than Sir Robert's formal stereotype Ionic is here required—something far more worthy of the particular occasion, which is no every-day one. Let him, therefore, for once venture to disregard scrupulous adherence to the authority of precedent, and give us upon his own authority what may be quoted as a precedent by others. He can very well afford to do so, since he has long ago done enough to fully establish his character as a "classical" copyist, and has yet to convince us that he can be anything more than a copyist. Merely to do again what he has already done so oft before, can hardly add another laurel to his wreath. Let him then forget his Post Office Ionic, his College of Physician Ionic, and all his other *various* (?) Ionics, and now give us an example of what may be made of an order whose "capabilities" are by no means so exhausted as to afford no fresh ideas. At all events let him bestow some study and greater finish upon his entablature, and let him by all means be less grudging of cornice. Some enrichment of frieze, and sculpture in the pediment if there is to be one, as we suppose there is, over the central octastyle—would not be amiss, more especially as we have at present no one example in the metropolis, in which sculpture is applied in both ways.

There is, indeed, one thing in the plan that is so far from promising well, as to be very ominous, which is, that there will be windows throughout within the colonnades. Even if rendered ornamental features in themselves, such apertures must prove injurious to the general composition, and at variance with its columnar and polystyle character; besides which, windows are by no means the architect's forte, nor does he ever attempt to turn them to account in his designs. Such being the case, instead of making any favourable promise, the windows rather *threaten* to prove blemishes and positive defects, and to render the façade little more than a variation of that of the Post Office, a respectable quaker-like building, encased in columns; consequently, though both the one and the other may be unexceptionable in themselves, the combination is likely to prove very unsatisfactory unless it turn out in this instance something very different indeed from previous specimens, by the same architect. Very much, indeed, will depend upon a variety of circumstances in the elevation, which, even were we acquainted with them, can no more be described than can all the traits and lineaments that contribute to make up the general air and expression of a countenance, and which, though taken singly, seem of no importance, are in reality of the greatest, with regard to the ensemble and the general impression made by it.

Willing to entertain hopes, we feel that we have very great cause for fears, and not least of all on account of the reserve manifested on the one hand, and the indifference on the other, relative to the intended façade, notwithstanding that so very much depends upon it, because it is that, and that alone, which can now be made to render the building one of "monumental" aspect externally—and by "monumental," we mean something more than that degree of it derived from size and material, or from the mere introduction of columns. We have a right to look for even very much more than negative merit upon such an occasion, since should we obtain no more than that, the building will prove if not exactly an architectural failure, another lamentable instance of a noble and rare opportunity that will have been nearly flung away.

If—as is very likely—our remarks shall be thought to exceed the due limits of criticism, by prejudging what is not yet in existence, and by imputing to it defects imagined by ourselves, we do not pretend to say that such is in no degree the case. Our saying anything at all may be officious, impertinent interference; but let there then no longer be any room for making unfavourable and ominous surmises, as there certainly is at present. As to forming a judgment beforehand, that is matter of very little difficulty or uncertainty where Sir Robert Smirke is employed, for all his productions have so little character except that derived from his peculiar mannerism, that it is hardly possible to err in calculating the result of what he is about to do from what he has done—and that not very much in his favour. Should we here have erred altogether—why so much the better; and most happy shall we be to find that Sir Robert will have greatly surpassed not himself alone, but most others in the profession; and that the façade of the British Museum will show what may be done by us in the Grecian style, no less satisfactorily than the new Palace at Westminster already shows what can be accomplished by us in the Gothic. May the one prove a worthy rival to the other, and may there be cause for applying to them the remark—*Pares magis quam similes!*

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## CANDIDUS'S NOTE-BOOK.

### FASCICULUS LI.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

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I. There is just now quite a cartoon fever or epidemic raging among us. We have "Hand-books"—should they not rather be called "Eye-books?"—which profess to teach us how to look at cartoons; and an advertisement has lately appeared with "The Cartoons" prefixed to it, which begins by informing us that the "present character of art is contrary to the eye, and the evidence of common sense," and concludes by assuring us that there is no hope for success in cartoon drawing and fresco painting in this country, "till the laws of the eye be made the standard of accuracy, as laid down in Parsey's 'Science of Vision'"! This is, perhaps, one of the most ingeniously plotted things of its kind ever produced—quite a master-piece in the art of advertizing and its manœuvring; yet although admirably well-timed as far as the public are concerned, quite the reverse for the poor artists, who now discover that they should have bought the book *before* they set about their cartoons, and not after their works have been hung up in Westminster Hall. By the bye, how did the great *Frescanti* of Italy—or, for the matter of that, how have artists generally—been able to do so well as they have done, in the present benighted state of art, contrary as it has been all along to the "evidence of common sense"? Have the whole world, artists and critics alike—been hitherto labouring under a fatuous delusion, fancying things to be very fine which are now proved (?) to be contrary to common sense? Truly deplorable in itself, such delusion seems also to be hopelessly incurable, since no cures have been wrought by the Parseyian system. That not a soul can be induced to adopt it, is evident, since had it been applied at all in practice, the effect would have been too striking to escape notice. Only one experiment (the first and last) has been made with it, and that was by Parsey himself in a drawing exhibited at the Royal Academy, which, if not at all satisfactory in any other respect, completely satisfied the public as to the exact value of the "Science of Vision." Why it should now be recommended more particularly for cartoons, it is difficult to guess, for it is little more applicable to them than to flower painting. On the contrary, such a subject as Barry's Victoria Tower would be a capital one for showing the wonderful and curious effects produced by Parseyian perspective!

II. In making choice of a style for a building, it is necessary to consider not only if the style be suitable for the occasion, but also if the occasion be suitable for the style, and one where it can be shown to advantage. Should the building be of a kind to require a number of windows, Grecian architecture is not to be thought of, for though you may put Grecian columns, the genuine classical physiognomy of the style will be lost. Neither can the Italian *palazzo* style be employed to advantage, except where space can be allowed for it, so as to preserve its character in regard to its *proportions*—that is, the proportions between solid and voids. In this style narrowness of piers between the windows, and want of breadth between the windows on one story and those on another, is no less injurious to character and effect, than is wide intercolumniation in what professes to be Grecian architecture. The fault in either case is nearly the same; the difference being, that in the latter the defect is that of meagreness and "sprawlingness," in the other, that of littleness and "squeeziness." Much, therefore, as that particular species of the Italian style has to recommend it for street architecture, hardly is it applicable here, owing to the narrowness of the fronts of our houses. Mere continuity of design may be obtained by uniting several houses into one general façade, yet that alone is not sufficient, because it does not increase the space between the windows and the several floors, does not at all alter the proportions, but only increases the *number* of windows by repetition, and no more alters the character in regard to design, than the number of yards of it measured out alters the quality of a silk or other stuff.

III. The sticklers for precedent, and those who would fain discourage, or if they could, even prohibit all invention, and reduce architectural design to a system of mere copying, give us no very high opinion of their own powers. They dislike invention and originality, for pretty nearly the same reason that the fox objected to the grapes as being sour, because he could not get at them. Again, they dislike novelty because it "puts them out." Puzzled at what they are unaccustomed to, and having no positive principles of taste to guide them, they decide at once that that for which no established authority can be adduced, must *therefore* be illegitimate and licentious, and *because* it deviates from standards and rules, it must likewise run counter to correct principles of art. Mere novelty, indeed, is not originality, in the better sense of the term, and it certainly would be absurd to admire as originality and inventive imagination, the merely doing that which had never been done before. But then it is in the same manner, mere prejudice and bigotry to condemn a thing, however it may be done in itself, for no better reason than because it is now done for the first time. If an idea be a happy one in itself, what matters though it be not exactly legitimate, and though we cannot trace its pedigree back any further?—rather ought it, on that very account, to be all the more prized, as a valuable addition and real acquisition to our architectural stock. There is a vast difference indeed between crude, capricious whims and original ideas. To be original, requires not invention alone, but patient study also. It would be too much to expect that even the happiest idea should present itself to the mind all at once, fully matured, and in all the perfection it is susceptible of. Originality, too, consists not only in the putting forth entirely new ideas, but in the power of imparting freshness to what has become common-place, and of bringing out beauties that seem not so much to be now first discovered, as to have been before overlooked where they were lying for the first comer. By our attempting to keep art stationary, and allowing no fresh current of ideas to flow into it, it is at length rendered *stagnant* also, becomes dull and sluggish, and degenerates into a system of plodding routine and copying, without either feeling or intelligence.

IV. There are some serviceable hints to be derived from Westminster Hall, as now fitted up for the exhibition of the cartoons. It enables us to judge what would be the effect of a public picture gallery similarly planned, and formed out of a single large apartment, divided into avenues of convenient breadth, by means of screens carried up only a moderate height, so as to leave a lofty open space over head, showing the whole of the general roof or ceiling. In regard to this last mentioned circumstance, the appearance of the Hall is very striking, and the fine timber roof seems in some degree of greater expanse than before, owing to the space below being contracted. In fact, the Hall and cartoons together form quite a picture, especially when the sun breaks in towards the latter part of the afternoon, at which times, in addition to the sparkling brilliancy and catching lights where its rays directly fall, a glow is diffused over the whole. Even when the sun does not shine at all, there is a sufficient degree of light—subdued and quiet, but still sufficient, though it proceeds chiefly from the single large window at each end; for if those in the roof have been enlarged, the others beneath them have been stopped up. There are, therefore, no side windows except such as are very high up; yet though, as we may convince ourselves, it answers here, were the same mode to be proposed for a church, it would be objected to as totally inadequate. It seems to be one of our prejudices, that we cannot have too many windows in a building, nor too much light, as if a strong light must produce a corresponding degree of effect; whereas it more frequently diminishes and sometimes quite destroys it.

V. The Nelson Monument people would have done a good work, if, instead of hoisting up an enormously expensive column (for at the best the effect will be in no proportion to the cost), they had offered to remove the present trumpery-looking screen of the Admiralty, and erect in lieu of it a low but simple and dignified architectural elevation, the centre of which would have served as a basement for some sort of superstructure forming the "monument" itself, adorned with sculpture, and surmounted by a colossal figure of the hero of Trafalgar. There would surely have been neither impropriety nor want of meaning, in so attaching to that building a memorial of one of the most distinguished of British admirals. At all events the Admiralty would have had what it now very much wants—something to mark it to the eye, and to intimate that it is a public building, and one of some importance—at least in its purpose. It may, indeed, not quite unreasonably be objected that any piece of monumental architecture of the kind erected in front of it would neither have improved the actual appearance of that building, nor rendered it the friendly service of shutting it out from view; but that, on the contrary, the building would have shown itself as an unworthy accompaniment to the monument. Still there would have been no very great difficulty in contriving that the monument should appear an independent composition not otherwise connected with the "large house" behind it, than as being erected in the open space in front of the latter, as affording a convenient site between that house and the street. The site itself being somewhat confined would have been rather a favourable circumstance than the reverse, because the monument would have been of greater comparative or proportional magnitude. As a piece of colonnaded architecture or façade, the present screen looks positively diminutive; but an erection of the same dimensions might be made to appear almost colossal as a portion of a monument reared in the centre of it.

## NOTES ON EARTHWORK, &c., UPON RAILWAYS.

### Article VII.—Principle and Construction of Earth Wagons.

In a former paper (*ante*, p. 186, vol. v), when treating of the "plant" employed in excavations, the cost of earth wagons and the expence of repairs were fully stated. I am, nevertheless, induced from the little information to be obtained, to make wagons the subject of an entire paper. I will first allude to the introduction of wagons for railway purposes. Mr. Nicholas Wood, C.E., in his Treatise on Railroads, p. 12, states, on the authority of Gray's Chorographia, published at Newcastle, 1649, that "the carts employed in conveying the coals, were in 1602 called "waynes," and the carriages introduced by Master Beaumont, "wagons," and also that ever since that period the carriages employed upon railroads have been designated by the latter name; we may therefore infer, that the wagon of Mr. Beaumont was applied upon a railway, and that he was the first to introduce them into the north." Also, page 16, the ground being formed pretty even from the pit, the whole length of the intended railroad or 'wagon way,' as it was termed." Here we have the ancient term retained in the modern nomenclature of "railway," not railroad, which is contracted to rail, in town. The wagons which are now used to carry coals, quit their load at the bottom, it being hung on hinges, and the form of body is hopper shaped, and they are made to carry 53 cwt.

Earth wagons are used in the making of railways for conveying the excavated soil, and are of two descriptions, called End Wagons and Side Wagons, from the direction in which they discharge the earth, which is done by a tilt like a tilt cart, the end or side being raised as the case may be. The timber framing which carries the hinge on which the body of the wagon turns in the act of tipping, is called the "soles," and sometimes the framing of the body of the wagon is called the upper soles. The form of the body is generally nearly square; the chief desideratum is that the construction should be simple, and rigid or firm, and that the height should be no more than will allow the wagon body sufficient elevation for the earth to leave it with the impulse that the wagon has obtained before coming to the tiphead. The annexed engravings, Figs. 1 & 2, show the construction of one of

WAGON, NORTH SHIELDS RAILWAY.

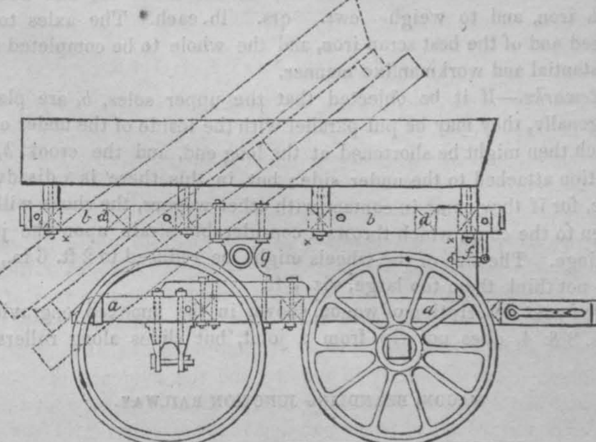


Fig. 1.—Elevation.

Plan of Top.

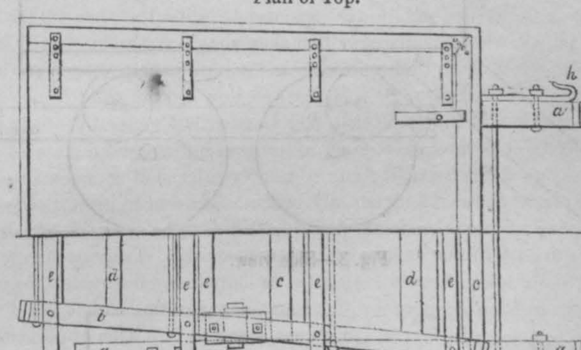


Fig. 2.—Plan of Under-framing.

the wagons used on the North Shields Railway, drawn to a scale of 3 feet to the inch. The following is a specification describing the construction. The "soles," *a*, of the underframing to be 6 in. deep by 5 in. broad, with three cross "sheths," *c*, 6 in. by 4 in., having three bolts 1 in. diameter, one on the side of each sheth to keep the soles together. The soles, *b*, of the upper frame, also, to be 6 in. by 5 in., with two cross sheths, *d*, 6 in. by 4 in., and two iron bolts the same as the under frame; these two sheths, *d*, to be morticed into the soles, *b*. Besides these, the upper frame to have four cross sheths, *e*, 4 in. by 3 in. thick, projecting over the frame and wheels on which the bottom deals are to be fixed. The length of the cross sheths, *e*, to be such as to make the wagon 6 ft. 6 in. broad at the hind end, and 6 ft. at the fore end, measured along the bottom deals, and the length in the clear of the bottom to be 6 ft. 9 in. and the top 7 feet. The "cleading deals" are to be 1¼ in. thick, of elm or oak. The top sheths, *e*, to be bolted down to the soles, *b*, with ½ in. bolts, a cross sheth, *f*, to be bolted down to the undersole, *a*, to support the front part of the wagon.

The framing to be all of good English oak; sides and ends to be 12 in. deep and $1\frac{3}{4}$ in. thick, also of oak or elm, and connected with kneed straps to the cross sheths, *e*, these straps to be $2\frac{1}{4}$ in. by $\frac{5}{8}$ in. thick, sunk flush with the surface of the deals, and fixed with $\frac{1}{2}$ in. bolts. The distance between the outside of the upper soles at the hinder end to be such as to allow them to come between the inner sides of the under-soles when the wagon is being emptied. The door or back end to be made to lift off. The end of the soles to be hooped with iron, 2 in. broad and $\frac{1}{4}$ in. thick. The joint or hinge, *g*, for the coup, to be formed according to the sketch, so as to give a broad surface to bear on. The wheels to be 3 ft. diameter, and the naves cut and hooped with iron, and to weigh cwt. qrs. lb. each.* The axles to be turned and of the best scrap iron, and the whole to be completed in a substantial and workmanlike manner.

*Remarks.*—If it be objected that the upper soles, *b*, are placed diagonally, they may be put parallel with the inside of the under ones, which then might be shortened at the long end, and the crook, *h*, for traction attached to the under side; but in this there is a disadvantage, for if they come in contact with other wagons, the shock will be given to the coup, which throws a considerable strain upon the joint or hinge. The size of the wheels might be reduced to 2 ft. 6 in., but I do not think them too large, viz. 3 ft.

The next description of wagon, shown in the annexed engravings, Figs. 3 & 4, does not tip from a joint, but slides along rollers or

WAGON, BRANDLING JUNCTION RAILWAY.

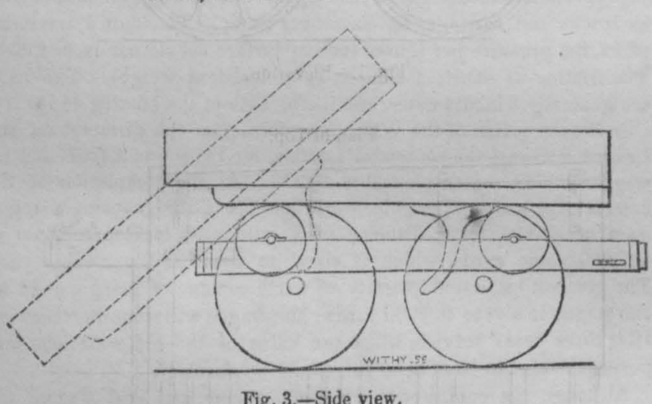



Fig. 3.—Side view.

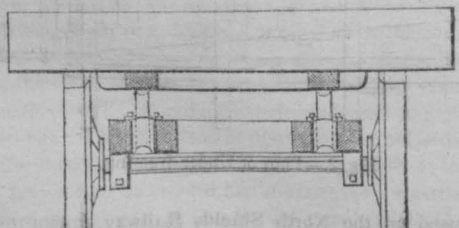


Fig. 4.—Transverse section.

sheaves, with a curved stop attached to the body, which arrests the sliding motion; the momentum causes the body to tilt up. This construction possesses many advantages; the wheels are large, and the weight is well distributed amongst them, it carries a large quantity, and is at the same time low; it is also easy to tip, the hinder sheaves being set a little higher, it almost runs when the catch is disengaged, two men at the embankment end can easily recover the coup. I sent a sketch of this construction to a friend who wished to make some; he inquired all over the north, of parties who would leave no stone unturned to serve him, yet he could not learn anything about this construction except from the sketch I sent. I mention this to show the difficulty of collecting information of this kind, as most parties make a mystery of trifles, who are engaged in such constructions. It is one of the attributes of want of education, and an external sign of a contracted soul. The wagons used on the Midland Counties Railway were similar to those just described, excepting that the sheaves were 8 inches diameter, and set lower, within the thickness of the under frame, so that the construction is a little lower than the former.

WAGON, HARTLEPOOL RAILWAY.

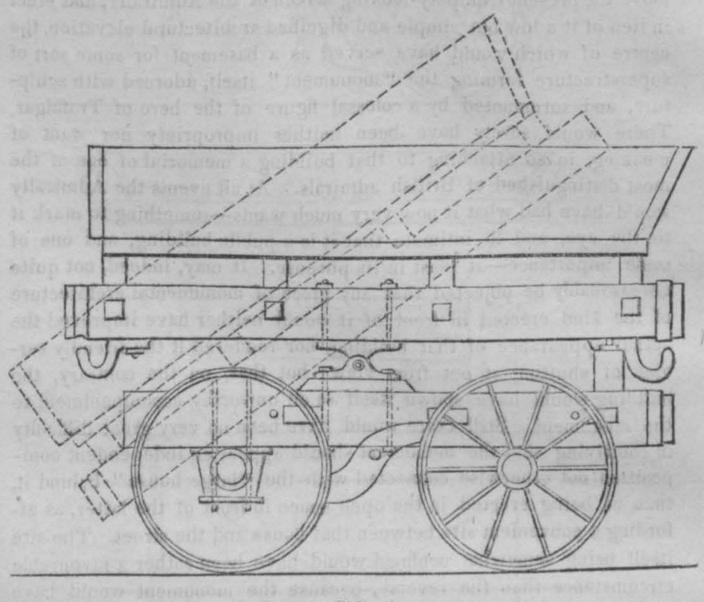


Fig. 5.—Side view.

Plan of Top.

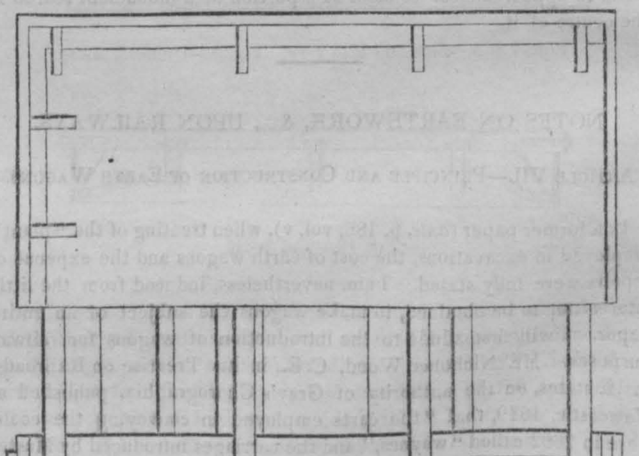
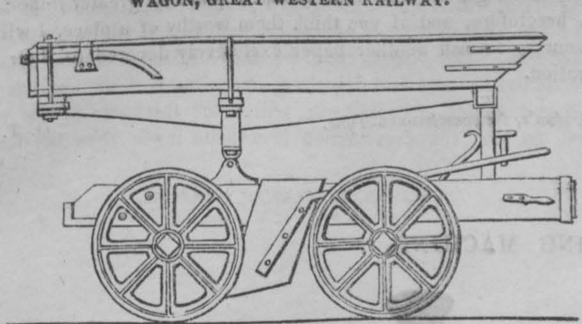
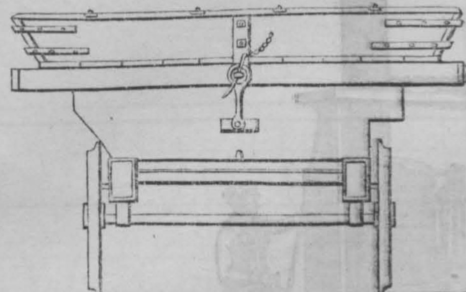


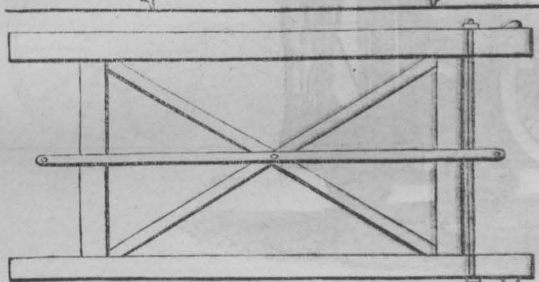
Fig. 6.—Plan of Under-framing.

Figs. 5 & 6 show a wagon used on the Hartlepool Railway: it tips from a hinge, and the draw bar is attached to the body of the wagon, and the upper and under frames are of nearly equal lengths. Figs. 7 to 10 show the construction of a wagon used on the Great Western Railway, drawn to a scale of 3 ft. to the inch. It is nearly similar to the last, excepting that the draw-bar is attached to the under frame and that the upper and under frames are of unequal lengths, which is a decided improvement, as it leaves a space between each wagon, so

WAGON, GREAT WESTERN RAILWAY.







Figs. 7 & 8.—Side and End view. Fig. 9.—Under-framing.

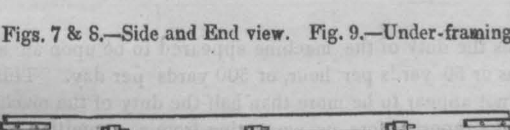


Fig. 10.—Tail-board.

that when an accident happens, the driver has some chance of escaping from being crushed between two wagons when they buff against each other. The following are the dimensions of this wagon; length on the top, 8 ft. 3 in., and bottom 7 ft. 8 in; breadth at top in front, 7 ft. 2 in., and end 7 ft. 8 in.; the bottom is 1 ft. less, and is $1\frac{1}{2}$ in. thick; the sides and end are 2 in. thick, the bottom is 1 ft. 5 in. above the under soles; the soles of the under frame, 5 in. wide and 8 in. deep, the sheths, 5 in. by 6 in.; diagonal braces, 3 in. by 6 in.; width in clear of soles, 3 ft. 3 in.; length of soles, 8 ft. 3 in. Wheels 2 ft. 6 in. diameter. I must observe that considerable talent and experience was employed in consultation upon this wagon before it was adopted; it is of maximum size, low, firm in construction, and strength of materials well proportioned; the appliances of the break, and disengagement of the tail board, are skilfully applied. As the draw bar was found not to answer so well when attached to the body, it was removed and fixed to the under-frame, and that by the elongation of the under-frame the shock is given to it and not to the body; therefore the hinge which is most liable to be broken, receives no shock. I can fully recommend this form of construction.

On the Midland Counties Railway, a wagon of a different construction to any of the preceding was used, both the sheaves and joint being dispensed with, the whole body of the wagon being lifted up from the hinder axle in the act of tipping, and the two axles being retained at an equal distance, so that the wagon falls to its original position as soon as the coup is recovered. I have seen wrought iron used for bodies of wagons of this construction, which answers a very good purpose.

Several attempts have been made, but invariably without success, to combine the end and side wagon in one construction, by making the body of the wagon to revolve. Mr. Cuthbert Burnup made one so early as 1829, for the Newcastle and Carlisle Railway as a pattern, which I think obtained a premium. Wagons of a good construction are a very material point for the consideration of a contractor; and as the days when Banks flourished are past, they are the main thing a contractor has to rely upon for a profit, if there is to be one in the present day.

The diameter of wheels for $1\frac{1}{2}$ yard wagons is usually 24 inches, and for $2\frac{1}{2}$ yard wagons 30 inches. The iron work in each wagon consists of draught hooks, draw bar, angle plates, breaks, tail-board irons, coupling chains, bolts and hoops. In taking dimensions, hoops are all outside measure, and bolts are measured from inside of head to outside of nut. In one wagon nearly 400 lb. of iron is used, including say a dozen hoops and twelve dozen bolts. The best wood is elm of English growth, which is better than oak, not being affected to a similar extent by the abrasion.

A wagon made to contain $3\frac{1}{2}$ cubic yards, is found in practice to be too large, $2\frac{1}{2}$ yards being found better, and in some cases they are made to contain only $1\frac{1}{2}$ cubic yards. The axle's diameter should be in proportion to the weight of the wagon. The bearings are internal, not as trucks and carriages for passenger traffic. To obtain a maximum effect, the pressure per square inch of surface should not exceed 90 lb. The friction of attrition alone is $\frac{1}{10}$ of insistent weight. The axles are generally 3 in. diameter, and the breadth of the bearing $4\frac{1}{2}$ in.

In the execution of the Willesden contract on the Birmingham and London Railway, the contractor's outlay for rails was £4767, and for wagons £3588, together equal to £8355. At the completion of the contract, the rails and wagons were sold for £3237, causing a deficiency of £5118, for a distance of $\frac{5}{8}$ mile, and for the removal of 837,000 cubic yards, which is equal to about $1\frac{1}{2}d.$ per cubic yard. The greatest estimated quantity of earth capable of being moved by one wagon in a year is 5000 yards; the wagon will require renewing after three years' service, when the value of the old materials, supposing the cost to have been 16*l.* would be about 4*l.*

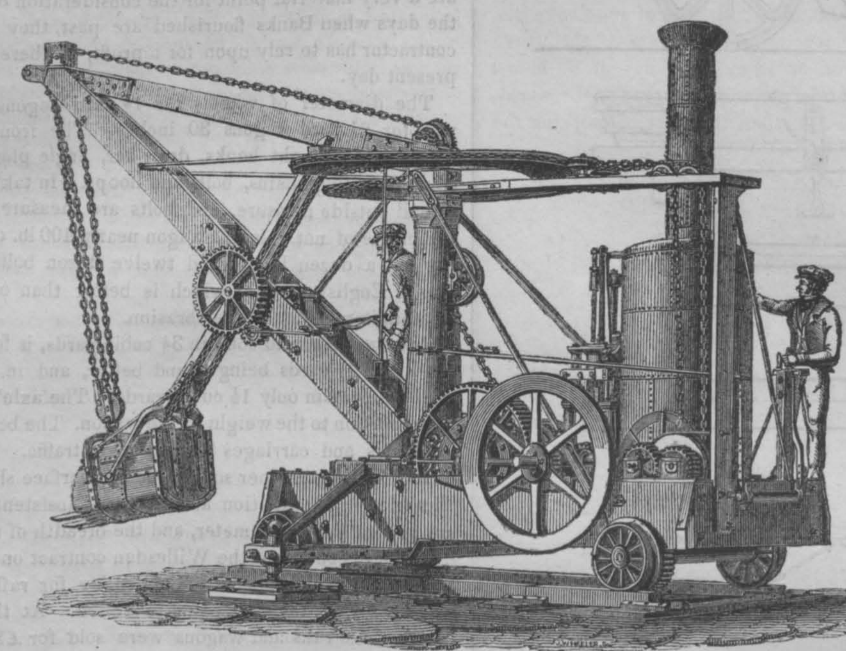
Although the construction of earth wagons and coal wagons are dissimilar, yet the amount of capital employed in the more permanent operation of conveying coals is not so much proportionally greater as would at first sight appear. On the Brandling Junction Railway, a thousand wagons are employed, at a cost of £13,000; and the charge per annum for repairs and interest is £4000. The company have taken them into their own hands. The Midland Counties Railway expended nearly £7000 in coal wagons, for the use of which they charge at the rate of one farthing per ton, and a toll of 1*d.* per ton; and estimate depreciation and repairs at 14 per cent per annum. The North Midland charge 1*d.* toll, and parties find their own wagons, the company having no stock of wagons. The cost of plant for earthwork under a mile lead, including all expenses, is generally taken at $2\frac{1}{4}d.$ per yard, being 1*d.* for rail and $1\frac{1}{4}d.$ for wagons, or half the cost of labour; and in a former article I showed that nearly £7000 was spent in one contract in plant alone.

I think sufficient has been said in justification of devoting an entire article to this subject, and I can with a good grace affirm, that little, if any, detail is to be had in any of the works recently published, generalization being the order of the day. How far I have fulfilled my promise of entering on the construction of earth wagons, as noticed at the conclusion of a former paper, I must leave to the readers of the *Journal*. Few persons have had opportunities so extensive perhaps to observe different constructions, as I was engaged on three public lines of railway during their construction, and, besides, visited most of the principal railways when in hand. I have known the faulty construction of wagons make a halfpenny per yard difference in the price of labour in excavations; and when it is considered that the quantity of excavation on some lines extends to nearly 100,000 yards, the amount then lost was nearly £4000 per mile, or about the whole cost of the permanent way. This I think is sufficient to show that this subject is worthy of attention in all future lines of road.

Now that railways are being made single lines or partly double; points, crossings, and turn-outs, assume a place of greater importance than heretofore, and if you think them worthy of a place, I will endeavour to furnish another paper exclusively devoted to their consideration.

*St. Ann's, Newcastle-upon-Tyne.* O. T.

## THE STEAM EXCAVATING MACHINE.



We have already had the pleasure of introducing this important machine to the public, and we now avail ourselves of the opportunity of giving some further account of it. As is well known, it is of American invention; and this individual machine was imported from the United States, after having been employed on a railway there, for the purpose of testing its capabilities in this country. It is now at work on the Eastern Counties Railway, about 20 miles from London, and is exciting much attention. In its present state, the machine is rather complicated, but it is susceptible of great improvement; and we have no doubt that any machines manufactured in this country will be much simplified. For this purpose it cannot be in better hands, the management of the patent being entrusted to Mr. John Braithwaite, the engineer, whose mechanical attainments are well known to the public, and who is well qualified to turn a machine of this kind to the best account.

We shall now proceed to describe the performance of the engine, having already given its working details, with an engraving in the *Journal*, p. 147, No. 68, to which we must refer our readers. The accompanying engraving is a perspective view of the machine when at work, and it will be seen by it, that one man, the engine tender, stands behind, to regulate the performance of the engine, and another man in front to regulate the motion of the scoops and to turn the jib or crane to the right or left, as may be required. By the aid of this jib the scoop is enabled to take a sweep of 30 ft. and clear away obstructions before it to the height of about 14 feet.

The cubic content of the scoop is 1½ yard, and it lifts about 1¼ cubic yard, two of which is about a wagon load of 2½ cubic yards. If the wagons were brought up as fast as the machine could supply them, it would fill 30 per hour. During the day we inspected the machine, it loaded 26 wagons of 2½ cubic yards each within the hour; and at another performance, it filled 103 cars in 5½ hours. By these trials the duty of the machine appeared to be upon an average 20 wagons or 50 yards per hour, or 500 yards per day. This quantity does not appear to be more than half the duty of the machines as detailed in a report before us, emanating from a committee of managers of the American Institute, New York, especially appointed to examine the machine. The committee state—

"The excavator has been employed for three years upon the Western Railroad and other places, and that this test showed an immense saving of expense. It is calculated to do the work of 150 men, and will fill cars as fast as they can be presented to receive their loads. Allowing for stoppages, one minute may be given as the average for filling a car of 1½ cubic yard. "The interest for the cost of the machine, wear and tear, men's wages, fuel and oil, 13½ dollars, (about 2*l.* 16*s.*), but to cover the contingencies, say 20 dollars."

There is also another report, showing the daily performance of two machines employed for two months, in almost constant work, at Brooklyn, New York, during which period the two machines worked collectively 881 hours, and excavated and loaded 92,593 cubic yards of earth, equal to 105 cubic yards per hour, or 1080 cubic yards per day. The machines worked during the above period upon an average nearly ten hours per day, which is equal to the working hours of a man. The quantity which one navigator can remove, or "get and fill," in one day, is about 10 cubic yards, or 1 cubic yard per hour; we have, therefore, the performance of one machine equal to 105 men, according to the statements of the American engineers.

We will now proceed to examine the comparative cost of working by the machine and manual labour. For this purpose we must calculate the power of the engine which is called a 10 horse engine, but on account of the high pressure at which the steam is worked, it will be found equal to 34 horse effective piston power. The following are the particulars of the engine:—

Diameter of cylinder 9 inches=63·6 square inches.

Length of stroke, 1 foot; number of strokes per minute, 100 to 110—say 200 feet per minute.

Pressure of steam, 90 to 100 lb. per square inch—say 90 lb.

Fuel—coke.

Then we shall have the engine power $= \frac{63·6 \times 200 \times 90}{33,000} = 34·7$ horse power on the piston. which if taken in the same proportion as low condensing engines, the nominal power of which is taken at only 7 lb. pressure, or about half the effective piston power, we shall have the nominal power of the engine equal to 17 horses, the consumption of which may be taken at about 10lb. of coal, or 8 lb. of good coke per horse per hour, which will give for the consumption of the above engine $17 \times 8 = 136$ lb. per hour, or 12 cwt. per day of 10 hours. If we take the cost of the coke at 35*s.* per ton. delivered at the works, we shall have the cost of the fuel 21*s.*, then the cost of working the machine per day may be stated thus:—

| | *s.* | *d.* |
|---|---|---|
| Coke | 21 | 0 |
| Oil, tallow, &c. | 2 | 0 |
| Engine tender | 6 | 0 |
| Man on the stage | 5 | 0 |
| 1 labourer assisting | 3 | 6 |
| Sundries | 2 | 0 |
| Cost per day | 40 | 0 |

This will be the cost for removing 500 cubic yards of earth, but exclusive of repairs, depreciation, interest on cost of machine. The cost of making one of the machines we estimate at 1200*l.* The cost of manual labour may be taken for "getting and filling" (See *Journal* Vol. V., p. 187) at 4½*d.* per cubic yard, then,

500 cubic yards at 4½*d.* = 9*l.* 7*s.* 6*d.*

We have here a difference of 7*l.* 7*s.* 6*d.* between the cost of engine and manual power; and if we make an allowance for the repairs of the machine, depreciation, interest, &c., 2*l.* per day, there will be a saving of 5*l.* 7*s.* 6*d.* We may, therefore, set down the actual cost of engine power at 2*d.* per yard, which would give 4*l.* 3*s.* 4*d.* per day, for 500 yards, thus clearly showing that the steam excavator must ultimately supersede manual labour on account of its cost and rapidity in execution for all extensive cuttings, either for railways, canals, or docks; but if we make our calculations according to the report of the American engineers, allowing the duty of the machine to be 1050 cubic yards per day, the calculation will stand thus:—

| | £ | *s.* | *d.* |
|---|---|---|---|
| 1050 cubic yards by manual labour at 4½*d.* | 19 | 13 | 9 |
| Deduct—Working of engine per day 2*l.* } Repairs, depreciation, interest, &c., 2*l.* } | 4 | 0 | 0 |
| Saving | 15 | 13 | 9 |

By this calculation the cost of excavation is not quite 1*d.* per yard.

The following testimonials, from engineers in America, will show their opinions of the machine.

*Engineer's Office, Western Railroad, Springfield, October, 9, 1841.*

Dear Sir,—In reply to your two letters of the 1st and 22nd September, I have to state, in relation to the Steam Excavator of Carmichael, Fairbanks, and Otis, that it has been most successfully and advantageously in use for the last three years on this road. I have often witnessed its operating in all kinds of excavation, except rock, and in every case I consider it to work to better advantage than men with picks and shovels could. We have experienced great advantage in the expedition with which excavations are made by this machine. Of course, like all other modes of excavation, it will perform the greatest amount of work in a given time in the easiest kind of excavation, that is, in coarse sand; it has removed often as much as one thousand yards per day in such; but I consider it of most importance and advantage in the kinds of excavation where the ordinary modes experience the greatest difficulties, for instance, in stiff clay and in very coarse gravel, where it is difficult to penetrate with the common shovel.

I consider this machine of great value, and it can be used with great advantage whenever the quantity will justify the first cost. It is a simple machine, easily managed, and not costly.

Respectfully, your obedient servant,

George W. Whistler, Engineer, W. R. R.

*Springfield, September 6th, 1841.*

Dear Sir,—In reply to your letter of the 1st instant, I have to state that the Excavating Machine of Carmichael, Fairbanks, and Otis, has been in use on the Western Railroad upwards of three years. I have witnessed its operations in stiff clay, in compact gravel, mixed with boulders of different sizes, in quick sand, and in common sand and loam. In all these various soils, the machine has worked advantageously, and the most so I consider in the cases which present most difficulty when the ordinary modes of excavation are resorted to—to wit, in the clay and the quick-sand.

I have not at hand the means of stating the amount of material excavated per month in the several soils enumerated, but I recollect that in August 1840, in sand and gravel in the section, it excavated 19,000 cubic yards in twenty-five working-days, and 1000 yards per day were excavated for several days in succession. I consider the machine of great value, susceptible of being applied advantageously wherever earth in any quantity is to be removed, easily kept in repair, and by no means a costly engine.

It is now, as you are aware probably, applied exclusively to work on *terra firma*, but the engine may readily be placed upon a scow, and used with great effect in dredging.

Respectfully,

W. H. Swift.

## APPARATUS TO REGULATE THE SUPPLY OF WATER TO BOILERS.

It is becoming a very common practice, and there can be no doubt as to its being attended with great advantage, to use steam of fifteen and twenty pounds pressure per square inch, instead of two and three pounds per inch, as is usual with the Boulton and Watt engines, and to reduce its elastic force, previous to its passing to the condenser, by allowing it to expand within the cylinder. Having lately been called upon to fit an expansive apparatus to an engine of this class, it of course became necessary to make considerable alteration in the apparatus previously employed to regulate the supply of water admitted into the boiler. To effect this alteration in accordance with the principle of the old apparatus, it would require a feed-pipe some thirty feet high, with the usual complement of rods, levers, counterweights, &c., to communicate motion from a float upon the surface of the water within the boiler to a stop-valve at the top of the feed head. This principle is, however, in some instances adhered to, to a very great extent, but in the present it would have created a frightful "monument," too much so to be tolerated by a town which *once* boasted great engineering skill. In order to avoid this, I contrived an apparatus which answers the purpose beautifully, and has such a remarkably simple outward appearance as to induce me to take the liberty of submitting it to the readers of the Journal.

The accompanying engravings consist of two views of my apparatus. Fig. 1 is a side elevation, and fig. 2, a vertical section. The parts distinguished by letters are as follows:—T, the top of the boiler; W, the water level; V, the valve-chest, cast on the end of the pipe P; C, a compensation valve; F, a float, encircling the pipe P (made of sheet copper); R, three small rods descending from the float to the three ends of the crossbar B, which are shown flatwise in fig. 3; E, the pipe to convey water from the feed-pump; S, a small rod for connecting the valve C with the crossbar B; D, a door, fixed by four screws to the side of the chest, which may be readily removed in case of examining the valve.

With this simple arrangement, it will be observed, there is not a packed joint of any kind through which the steam can escape, and here we get rid of that very common and disagreeable hissing of the

Fig. 1. Fig. 2.

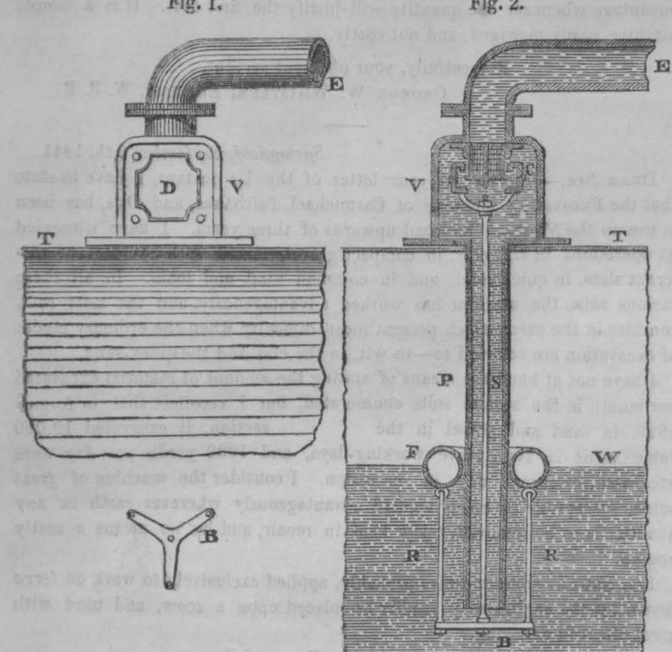



Fig. 3.

steam from around the float-wire, &c., the effect of which always proves so injurious to the boiler.

The compensation-valve, I presume, will be too readily understood to need any explanation from me; it may, however, be noticed, that it is composed of brass, and that the part which is attached to the float, as well as the other part, is cast is two pieces, as may be distinguished by the section-lines in fig. 2—this is essential to the putting of the valve together. It may be further observed, that, to avoid any alteration in the original feed-pump, a spring-valve is introduced in a convenient part of the pipe adjoining to E, just sufficient to allow the surplus water to make its escape without subjecting the plunger to any additional strain.

Vesper.

*Leeds, July* 1, 1843.

## GRESHAM COLLEGE.

*(With an Engraving, Plate XI.)*

The widened line of communication from the Post Office to Lothbury and the Bank is an improvement that was greatly needed, for it used before to be not only most inconveniently but dangerously narrow in many parts, and those where there was the greatest traffic of all. Nor has the improvement which has taken place in that respect been unattended with considerable improvement in regard to architectural appearance, both as regards the elevations of the houses generally, and one or two designs in particular. Of these last, the chief is "Gresham College," which stands at the corner of Cateaton and Basinghall streets, and which, if we are rightly informed, is now to give its own name to the first of them, it being intended to be called Gresham Street. This building was erected from the design of Mr. George Smith, architect to the Mercers' Company, at whose expense the building is erected. The elevation, represented in our engraving, is that of the entrance front towards Basinghall Street, and is a more than ordinarily dignified composition, and of marked monumental character. Besides that the order itself is upon an ample scale, (the height of the columns being rather more than 35 feet,) it displays itself to very great advantage, owing to there being no windows, nor any other aperture than the entrance door; consequently there is great repose and breadth of surface, besides a decidedly peculiar character, of which we have so very few instances even among our public buildings—which do not always show with the happiest effect the orders applied to them—that it amounts almost to a novelty. It is here too, a greater merit than it ought to be, that the order is treated consistently—that, instead of being at all neglected, the entablature is well finished up with carved mouldings to its architrave, and the cornice itself made unusually bold and rich, so as to be a striking feature in the whole composition, and give decided expression to that important part of an elevation: and if it may seem exaggerated in its proportions and enrichments, to those who are accustomed to the meagre and shelf-like things usually put as the finishing of an Ionic or Corinthian entablature, even excess in this respect is far less reprehensible than the opposite fault of deficiency. We do not say, that as the columns are unfluted, too much embellishment is put into the cornices, because a cornice equally rich might be applied where there are no columns at all; still we are of opinion, that had, in this instance, the three-quarter columns been fluted, they would have been better relieved against the plain wall, and there would also have been a pleasing degree of variety arising from the contrast between them and the angle pilasters.

Such further degree of decoration was all the more desirable, because owing to the aspect of this front—which is that facing the east, the effect of boldly defined light and shade, which it would else have, is nearly lost. Much, therefore, is it to be regretted that this elevation could not be adopted for the south one, in which case it would have had the further advantage of being towards the wider of the two streets—and it evidently shows itself to be properly the *front* and not the *side* of the edifice. At present the side which is now made the front, looks too secondary in importance to the other, and as seen at the same time with it in an angular view of the building, not sufficiently of the same character, for while the east elevation is nearly solid, the south one is—we were going to say—full of windows; and so, indeed, it is in one sense, because, though there are only six windows in all, viz., three on a line on each floor, they fill up the design too much, the extent of frontage being only 37 feet, which was not sufficient to allow of such breadth for the piers as would have produced a character of solidity, in keeping with that of the entrance front.

It could further be wished that the windows themselves were more alike as to style, for the three lower ones, which are arched segmentally, and have "kneed" architraves, do not very well accord in character either with those above them, or with the rest of the design. The upper windows have slightly projecting stone balconies before them, and full entablature dressings, which do not leave sufficient space between them and the general entablature of the order; and unless these windows could have been kept from rising higher than the lower line of the pilaster capitals, that inconvenience might have been in some degree obviated, by giving the pilasters themselves only shallow antæ-caps.

The interior is devoted to the purpose of lecturing; the upper story contains a well arranged but small theatre, and the ground-floor contains private rooms for the professors, entrance hall, and a noble staircase.

The Greenwich Pier.—The lawsuit between the stone pier company and Messrs. Grissell and Peto, the contractors, has been stayed by proceedings in Chancery. Messrs. Grissell and Co. have obtained an injunction; the case has been referred to eminent counsel, and an amicable arrangement entered into for both parties to bear an equal proportion of the expense to be incurred in putting the permanent pier into really substantial condition. It is stated that to do so at least 17,000*l.* must be expended. The pier company are driving a number of piles close to and alongside the watermen's floating pier, and are determined to drive them away from their position.—*Times.*

## A NEW AND SIMPLE METHOD TO FIND THE PERPENDICULAR HEIGHT OF MOUNTAINS, HEADLANDS, &c. ABOVE ANY GIVEN DATUM, FROM BAROMETRICAL AND THERMOMETRICAL OBSERVATIONS.

By OLIVER BYRNE, Mathematician, Author of "The Doctrine of Proportion," &c.

RULE.—Add the allowance found in Table I for the difference of temperature taken by the attached thermometer, to the logarithm of that height of the barometer which corresponds to the least degree of the thermometer. Then to the logarithm of the difference of the logarithms of the heights of the barometer observed at the higher and lower stations, thus corrected, add the logarithm of the allowance found in Table II, for the mean temperature of the detached thermometer when increased by the constant number ·92102; this sum will be the logarithm of the required height in fathoms. Observe: the first four figures of the logarithms of the heights of the barometer, together with the indices, are to be counted whole numbers, and the numbers taken from Tables I and II must always have five places of decimals, though they need not always be used. Tables I and II may be dispensed with, as ·456789 answers to a degree of the attached thermometer in Table I, and ·0024680 to a degree of the detached, in Table II.

Previous to M. De Luc commencing his experiments on the barometer, it was considered that a mean between the two temperatures shown by the thermometer attached and the height of the mercury in the barometer at two different stations, was sufficient to determine the perpendicular distance of those stations. But De Luc found, by repeated experiments, that an additional or detached thermometer was likewise necessary, which has since been confirmed by General Roy, Sir G. Shuckburgh, and others.

However, before making further remarks, we shall illustrate the rule just given by practical examples.

TABLE I.

Of the allowance for the difference of the temperatures of the attached thermometer.

| | | | Tenths | Units | Tens |
|---|---|---|---|---|---|
| 1 | 0 | 4 | 567 | 8 | 9 |
| 2 | 0 | 9 | 135 | 7 | 8 |
| 3 | 1 | 3 | 703 | 6 | 7 |
| 4 | 1 | 8 | 271 | 5 | 6 |
| 5 | 2 | 2 | 839 | 4 | 5 |
| 6 | 2 | 7 | 407 | 3 | 4 |
| 7 | 3 | 1 | 975 | 2 | 3 |
| 8 | 3 | | 543 | 1 | 2 |
| 9 | 4 | 1 | 111 | 0 | 1 |

TABLE II.

Of the allowances for the mean temperatures of the detached thermometer.

| | | | | Tenths | Units | Tens | Hundreds |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 24 | 6 | 8 | 0 |
| 2 | 0 | 0 | 0 | 49 | 3 | 6 | 0 |
| 3 | 0 | 0 | 0 | 74 | 0 | 4 | 0 |
| 4 | 0 | 0 | 0 | 98 | 7 | 2 | 0 |
| 5 | 0 | 0 | 1 | 23 | 4 | 0 | 0 |
| 6 | 0 | 0 | 1 | 48 | 0 | 8 | 0 |
| 7 | 0 | 0 | 1 | 72 | 7 | 6 | 0 |
| 8 | 0 | 0 | 1 | 97 | 4 | 4 | 0 |
| 9 | 0 | 0 | 2 | 22 | 1 | 2 | 0 |

*Examples.*

1. The heights of the barometer at the bottom and top of a hill are 29·862 and 26·137 inches; the attached thermometer at the bottom and top indicates 68° and 63°; also, the detached thermometer at these stations gives 71° and 55° respectively. It is required to find the perpendicular height of the mountain.

| *Thermometer attached.* | | | *Thermometer detached.* | | |
|---|---|---|---|---|---|
| Lower station | .. | 68° | Lower station | .. | 71° |
| Higher " | .. | 63 | Higher " | .. | 55 |
| Difference | | 5 | | | 2) 126 |
| | | | Mean | | 63 |

| | | | |
|---|---|---|---|
| Barometer at summit, where attached thermometer indicates least degree | 26·137, log. = 14172·557 | | |
| From Table I for 5 units we have | | | 2·28394 |
| | Log. corrected | | 14174·84094 |
| Barometer at base=29·862, log. | 14751·189 | | |
| Take | 14174·84094 | | |
| Log. | 576·34806 | = | 2·7606848 |
| Then, from Table II, for 6 tens | ·14808 | | |
| For 3 units (making in all 63°) | ·00740 | | |
| Constant | ·92102 | | |
| Log. | 1·07650 | = | 0·0320140 |
| Height in fathoms = 620·4385, corresponding to log. | | | 2·7926988 |

II. Wishing to know the perpendicular height of the mountain Chraughaun, in the county Wicklow, and having two barometers and detached thermometers which for months before agreed with each other in different states of the air, leaving an assistant on a level with the sea near Arklow, with directions to make accurate observations every fifteen minutes from 3 to 4 o'clock (our watches being previously regulated) I proceeded to the top of the mountain, and at the appointed hour commenced observations. The mean result of the five were as follows:—the barometer stood at the summit 28·635, and at the base 30·609 inches; attached thermometer, 61° and 65·5,° and detached thermometer 54·5° and 70°, respectively. It is required from these data to find the height of the eminence.

| *Thermometer attached.* | | | *Thermometer detached.* | | |
|---|---|---|---|---|---|
| Lower station | .. | 65·5° | Lower station | | 70° |
| Upper " | .. | 61·0 | Upper " | .. | 54·5 |
| Difference | | 4·5 | | | 2) 124·5 |
| | | | Mean | | 62·25 |

| | | | |
|---|---|---|---|
| Barometer at summit, where attached thermometer is least | = 28·635, log. 14568·972 | | |
| For 4 units, from Table I, we have | . | .. | 1·82715 |
| For 5 tenths | .. | .. | ·22839 |
| Log. corrected for temperature | | | 14571·02754 |
| Barometer at summit, where the attached thermometer is least | 14858·491 | | |
| Subtract | 14571·02754 | | |
| Log. of | 287·46346 | = | 2·4585880 |
| From Table II we have, | | | |
| For 6 tens = | ·14808 | making up 62°·25 | |
| For 2 units = | ·00494 | | |
| For 2 tenths = | ·00049 | | |
| For 5 hundredths = | ·00012 | | |
| Constant = | ·92102 | | |
| Log. of | 1·07465 | = | 0·0312671 |
| Hence the height in fathoms = 308·923, log. | | = | 2·4898551 |

It may be observed, that this experiment was repeated at different times, and consequently in various atmospheres, yet the result never varied two feet. We may, therefore, conclude that the highest summit of the Wicklow mountains is very nearly 1853 feet above the level of the sea.

This rule will be found to give results more accurate than either that of General Roy or of Sir G. Shuckburgh, and can be applied with greater ease.

General Roy makes the height in fathoms $= (10000\, l \mp \cdot 468\, d) \times (1 + [f - 32^\circ]\, \cdot 00245)$.

Sir G. Shuckburgh makes it,

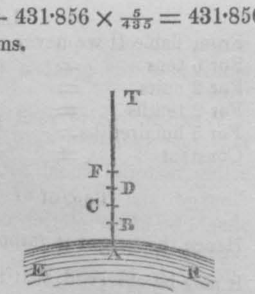
$(10000\, l \mp \cdot 440\, d) \times (1 + [f - 32^\circ]\, \cdot 00243)$ fathoms; where $l =$ the difference of the logs. of the heights of the barometer at the two stations; $d =$ the difference of the degrees shown by Fahrenheit's thermometer attached to the barometer; $f =$ the mean of the two temperatures shown by the detached thermometers exposed for a few minutes to the open air in the shade, at the two stations. The sign *minus* takes place when the attached thermometer is highest at the lower station, and the sign *plus* when it is lowest at that station. 10000 (log. $m$ — log. M) was the expression formerly given to find the altitude in fathoms, $m$ M being the heights of the mercury at the base and summit of any eminence. This formula is very easily applied, and not far from the truth when an allowance is made for the increase of temperature above 31°, for this is the degree of temperature to which the above formula is calculated, or rather adopted. As air expands very nearly $\frac{1}{435}$ part of its bulk with every degree of heat, and suffers the same contraction with every degree of cold, the following rule was usually given. *Rule.*—Observe the height of the mercury at the bottom of the object to be measured, and again at the top, as also the degree of the thermometer at both these situations, and half the sum of these two last may be accounted the mean temperature. Then multiply the difference of the logs. of the two heights of the barometer by 10000, and correct the result by adding or subtracting so many times its 435th part as the degrees of the mean temperature are more or less than 31°; the last number will be the altitude in fathoms.

We are too apt to say, when two or more phenomena happen together, that one is caused by the other; where all may be governed by some unknown phenomena. The writer of this article agrees with Mr. Pasley, that the philosophy is false which teaches that expansion is caused by heat, for without fire or heat water is expanded as it becomes ice, and air in the air pump vacuum; solids require fire as a means, but the expanding cause itself is perfectly distinct from fire. However, when experiments show that certain phenomena increase and decrease together, one may be taken as an index, if not as a function of the other; but great care ought to be taken not to draw general inferences from limited experiments. At some future time we shall explain why the attached and detached thermometers differ, and also show how they may be made to agree, and at present proceed to the more immediate object of the communication. To illustrate the rule just given, we shall add another example.

III. If the heights of the barometer at the bottom and top of a hill are 29·37 and 26·59 inches respectively, and the mean temperature 26°, what is the height?

Log. 29·37 = 1·4679039
Log. 26·59 = 1·4247183

0·0431856 × 10000 = 431·856. Then 31°−26° = 5 degrees, therefore by the rule, $431·856 - 431·856 \times \frac{5}{435} = 431·856 - 4·964 = 426·892 =$ the height in fathoms.




We shall now investigate the last formula, and give an outline of the theory upon which this proposition is founded. Let E A R represent part of the surface of the earth, and A T a column of the atmosphere. Conceive this column to be divided into a number of equal and infinitely small parts, as AB, BC, CD, &c., in each of which we may suppose the density to be uniform, because they are infinitely small. Now since the density of the air is always directly as the compressing force, therefore we have the density of the air in any of the portions AB, BC, &c., as the weight of the column of the atmosphere above that place; that is, if P represents generally the pressure, D the density of any place, P′ the pressure at any other place, and D′ its corresponding density, we shall have P : P′ : : D : D′; that is, the pressure is to the density in a constant ratio, and may be represented by $n$ to 1; therefore,

P : D : : P′ : D′ : : $n$ : 1, consequently abstractedly speaking,

$$D = \frac{1}{n} P,$$

$$D' = \frac{1}{n} P',$$

$$D'' = \frac{1}{n} P'', \text{\&c.}$$

That is, the density at any place is equal to, or rather may be measured by, the $n$th of the pressure of the column of the atmosphere above that place, or by the $n$th of the compressing force. Hence if we make P stand for the pressure at the surface A, and let each of the parts AB, BC, CD, &c., be equal to 1, then will $\frac{1}{n}$P represent the weight or pressure of the part AB, and therefore,

$P - \frac{1}{n} P = \frac{n-1}{n} P =$ the pressure at B, and $\frac{n-1}{n^2} P =$ the density or weight of BC. In the same way,

$\frac{(n-1)^2}{n^2} P =$ the pressure at C, $\frac{(n-1)^3}{n^3} P =$ the pressure at D, &c.

So that the pressure, and consequently the density, will decrease in a geometrical progression, as the altitudes increase in an arithmetical progression. Calling the density at the surface $d^n$, and the several altitudes 1, 2, 3, 4, &c. we shall have the following corresponding series:

| | | | | | |
|---|---|---|---|---|---|
| Altitudes | .. | 0, | 1, | 2, | 3, &c. |
| Corresponding densities | | $d^n$ | $d^{n-1}$ | $d^{n-2}$ | $d^{n-3}$, &c. |

Dividing the latter series by $d^n$ we have,

| | | | | | | |
|---|---|---|---|---|---|---|
| Altitudes | .. | 0, | 1, | 2, | 3, | 4, &c. |
| Corresg. densities | | 1 | $d^{-1}$ | $d^{-2}$ | $d^{-3}$ | $d^{-4}$, &c. |

This is strictly analogous to the property of logarithms. In fact the several altitudes form a peculiar system of logarithms of which the reciprocals of the corresponding densities are the natural numbers; from this circumstance they have been denominated atmospheric logarithms. From a similar circumstance the Napierian are termed hyperbolic logarithms, because they express the areas contained between the asyptotle and curve of an hyperbola. We shall write these atmospheric logarithms with large letters, thus, "Log," to distinguish them from the Briggean or common logarithms, which are written "$\log._{10}$," or simply "log." and also from the hyperbolic or Naperian which are denoted by "$\log._{n.}$" Let A, $a$, represent any two altitudes, and D, $d$, their corresponding densities, then will A = — Log. D, and $a =$ — Log. $d$;

$$\therefore A - a = \text{Log. } d - \text{Log. } D = \text{Log. } \frac{d}{D}.$$

Now it is a well known property in logarithms, that by assuming different values for the base, there will be as many different systems of logarithms; and it is equally well known, that in all the various systems of logarithms, the logarithms of the same numbers can be converted from one system to another, by a constant multiplier or modulus. The object of our present inquiry is to determine a constant multiplier that shall convert the common logarithm of a number into the atmospheric logarithm of the same number. To accomplish this, let

$$\text{Log. } \frac{d}{D} = x \log. \frac{d}{D},$$

$$\therefore A - a = x \log. \frac{d}{D},$$

Then making $a = o$, or which is the same, if we suppose $d$ to represent the density of the atmosphere at the surface of the earth, we shall have $A = x \log. \frac{d}{D}$.

In order to find $x$ let us take the height of a homogeneous atmosphere, when the temperature shown by the thermometer is 31°, and the height of the barometer 29½ inches at 26057 feet; then the density at the surface, and one foot above it, will be

$$a = o; \quad d = 26057.$$
$$A = 1; \; D = 26056.$$

That is, the pressure at the surface will be equal to a column of air of uniform density 26057 feet high; and consequently one foot above the surface = 26056 feet high, or a foot less. Since the densities are as the pressures, we have

$$A - a = 1 = x \log. \frac{26057}{26056};$$

making $26057 = n$, we have $1 = x \log \frac{n}{n-1}$

$$\text{but } \log. \frac{n}{n-1} = M \left( \frac{1}{n} + \frac{1}{2n^2} + \frac{1}{3n^3} + \frac{1}{4n^4} \; \&c. \right)$$

And when, as in the present case, $n$ is a large number, all the terms but the first may be neglected as unimportant; also, since M = ·43429448, the modulus of decimal or common logarithms,

$$\therefore \; 1 = x \times \frac{\cdot 43429448}{26057}$$

whence $x = \frac{26057}{\cdot 43429448} = 60000$, very nearly, or $x$ may be readily found from the expression $x = \frac{1}{\log. \frac{n}{n-1}}$

The above formula is reduced to

$$A = 60000 \log. \frac{d}{D} \text{ feet};$$

or putting $m$ and M the heights of the murcury at the earth's surface and at the altitude A, then the fraction

$$\frac{d}{D} = \frac{m}{M}$$

Also since 6 feet are equal to one fathom, the simple multiplier 60000 for feet becomes 10000 for fathoms, which is more convenient. Hence instead of

$$A = 60000 \log. \frac{d}{D} \text{ feet}$$

$$\text{We have } A = 10000 \log. \frac{m}{M} \text{ fathoms},$$

which is the formula formerly used in measuring altitudes by the barometer.

With respect to the height taken for the homogeneous columns of air different writers vary, but this difference does not affect the ultimate result. It is well established, that the height of an homogeneous atmosphere, whose density would be equal to that of the air at the earth's surface, and weight the same as that of the real atmosphere when compared with a column of mercury or other fluid of the same weight, the heights will be reciprocally as the specific gravities of the air and mercury or other fluid. So that if we take the specific gravity of the air at the earth's surface at $1\frac{1}{5}$, when compared with distilled water at 1000, and that of mercury 14000, also the column of mercury in the barometer = $29\frac{1}{2}$ inches, we have $1\frac{1}{5} : 14000 :: 29\frac{1}{2} : 344166$ inches = 28680·5 feet = 5·43 miles. But the specific gravity of fluids varies as their temperatures vary. It has been found by various experiments, that when the mercury in the barometer stands at 30 inches, and the thermometer at 55°, the specific gravity of air, water and mercury are nearly as $1\frac{1}{5}$, 1000 and 13600. Hence $1\frac{1}{5} : 13600 :: 30 : 340000$ inches = $28333\frac{1}{3}$ feet = 5·366 miles, the height of a homogeneous atmosphere. Again, taking the specific gravity of the air at the earth's surface at $\frac{2}{9}$, which some affirm, and the barometer at $29\frac{1}{2}$ inches, it will be $1\frac{2}{9} : 13600 :: 29\frac{1}{2} : 328255$ inches = 27318 feet = 5·1814 miles. Hence, generally, we may assume if the air was of the same density at all altitudes as at the earth's surface, its height would be between five and six miles. But it matters not what degree of temperature we assume, for we can always accommodate the result to any other temperature, as before observed, by augmenting or diminishing the result by the $\frac{1}{435}$th part for every degree above or below 31°.

It may further be observed, that the common barometer, with some trifiing alterations, of which we shall speak hereafter, is the best and most to be depended on; for many which are said to be improved have only the recommendation of deviating from it in simplicity. It appears from accurate observations, that mercury stands higher in tubes of larger than in those of narrower bore; and therefore, when observations are made with different barometers, attention should be paid to the difference of their diameters. In order to prevent the effects of the attraction of cohesion, the bore of the tube should not be less than one fourth of an inch; but one third of an inch would be better.

Note.—Further particulars relative to this important subject is given in a work about to be published, entitled "A New Theory of the Heavens and Earth."

## OBSERVATIONS ON THE CONSTRUCTION OF ROADS THROUGH BOG.

THE bogs in Ireland form a vast extent of surface, which for the most part, is profitless, save for fuel, but a large portion of which is capable of being converted at a small expense into good arable land, which would yield an average crop; but the absence of roads in these extensive wastes, has prevented the capital of individuals from being profitably invested, in the reclamation of those barren plains, now tenanted by the plover and the snipe.

It seems to have been the system with engineers of former days, to avoid by every means the construction of a road across bog, and accordingly they have not scrupled, by a very circuitous route, greatly to extend the distance between the termini in preference to encountering the unstable foundation of a bog, which the science of road-making has, in latter years, rendered a comparatively easy and safe undertaking. Still, even in modern works, it is to be regretted that so frequently is to be seen a road, otherwise well selected and judiciously laid out, materially injured by deviating from its proper course, in order to avoid an intervening bog; and as the engineer, in tracing a line of public road, should ever bear in mind that the chief advantages of communication is to open the country, and to afford every facility for improving and drawing out the resources of those lands, whose capabilities have been suffered to lie dormant for want of this advantage, the intersection of bogs by roads should therefore not be avoided.

The most favourable months in the year for commencing operations in the construction of bog roads, are June, July, August and September (if dry), since at those periods the surface is more free from water, and consequently the bog more firm than in the rainy months; and it is of the greatest importance to have fine weather for these works.

When a line of road passes over a shallow bog of from three to four feet in depth, with a firm and compact substratum, and when soling material could not be procured without the expense of land damage, and the cost of carriage should be great, or when the soling should be of an inferior or unsuitable quality, it will be most advantageous (provided the gradients will admit) to remove the bog mould altogether, to form the road upon the hard bottom, and to sink the grips sufficiently deep to prevent the moisture of the adjacent bog producing injurious consequences.

In the construction of a road over the surface of a bog, the first point to be attended to, and which is of the chief importance, is the thorough drainage of that portion of the bog upon which it is determined to place the road materials. When the line is lockspitted, a grip is to be cut on both sides of the road of sufficient capacity to command the complete drainage of the surface; and in soft bog, a second grip should be cut on both sides, at about 10 feet distance from the first; and it will be particularly necessary that great attention should be observed in keeping them free from impediments, and that there should be no obstruction to the free passage of the water. The second grip, in addition to the greater facility of drainage, will be found useful as a protection against persons cutting turf up to the very road fence, and in a short time, leaving the road (as is frequently the case) an embankment dangerous for travelling on, and liable to slip. The surface water should then be tapped off by means of mitre drains judiciously placed, and when the whole is perfectly free from water, the inequalities of the surface should be reduced by filling the hollows with heaty sods, and the formation conducted in the usual manner for roads upon ordinary upland ground, but it will be judicious to give the cross section greater convexity to allow for compression.

The laying on of the soling is the next operation to be attended to; and as to the period for undertaking this work, I must differ in opinion from many engineers, who strenuously insist that the soling should not be laid on, until one, and in some cases two seasons, after the grips have been opened. I would recommend, that when the surface of the intended road had been freed from water, by the means before mentioned, that the soling should be immediately put on, as the superincumbent weight will compress the bog, and thereby accelerate the process of drainage, and also protect it from the frequent saturations with rain, to which it would otherwise be subject, as by the formation all the surface water must fall off into the grips.

This opinion, which I now venture, is founded upon practical observation. About three years ago, when superintending the execution of a long line of road in the south of Ireland, under the direction of the Board of Works, which for about six miles was carried across bog of various depths, a portion of it was solid immediately after being drained, and a portion after the drains had been opened and the surface formed was left unsoled, in consequence of the winter setting in: in the following summer, when proceeding to complete the operations in the bog, I found that part which had been soled was firm and well consolidated, and in excellent condition for receiving the metalling, while that portion which had been unsoled, was in a much worse and softer state than the adjacent bog, especially where the surface had been cut for the purpose of reducing the inequality.

As the durability of a road will depend in a very great measure upon the soling, the quality of the material to be used for this purpose, is of great importance. Vegetable earth is certainly bad, and if, in the absence of better material, made use of, cartage should not be permitted upon it until after the metalling had been laid on. A compound of stiff clay and sharp sand, mixed naturally, constitutes an excellent soling substance, as it will form a tenacious unyielding crust, which will not be liable either to wash away or sink into the bog. This substance is frequently found under bog, and in such cases, will be the best which can be used, and the most economical. Seven inches in depth of soling will be sufficient for country roads where the traffic is not very great.

After the soling has been laid on and the compression and drainage completed, the fences should be made in the usual manner, with pipes or outlets underneath, to convey the water from the water-tables into the grips. Road contractors generally construct the fences, when cutting the grips, with the sods and turf mould which is raised therefrom; but this is both an incorrect practice and false economy, as the subsidence and compression of the bog will cause the fences to form a waving line, instead of the direction first laid out, and the weight of the soling will generally cause the surface between the fences to spread out, and then a larger area than required must be covered over with metalling, which will greatly increase the expense. In a bog road in the county of Kerry, fenced at the time of sinking the grips, and laid out 21 feet wide between the fences, I found, after the soling had been laid on and consolidated, and when about to spread the broken stones, that the width between the fences measured 23 feet. In this case there was a decided loss to the contractor, as he was obliged to cover with metalling the entire surface of the road, to within 18 inches of the water tables on each side.

The stoning and blinding is conducted in the same manner as in ordinary roads.

When a road is to be formed on an embankment over bog, the base of the embankment should be very wide, in order to extend the superincumbent weight over a large surface, and the sides should slope 2 feet horizontal to 1 foot perpendicular. The irregularities of the surface, upon which the embankment is to be raised, should be reduced, and then covered over with regular courses of dry heathy sods, with the heathy side placed downward, but the top course should be laid with the heathy side upward. When the embankment has been raised to the required height, the road should be formed solid, faced and stoned as before described. In a soft and yielding deep bog, the sods for the embankment should not be cut from that portion of the bog adjoining the road, or the embankment may subside very much, and cause the adjacent surface, from which the sods have been cut, to elevate.

I have seen the injurious consequences of this practice exemplified in many cases, but in two in perticular: in the first, the embankment subsided very much, and the gradients were completely altered, the longitudinal section of the road forming a waving line: in the second case, a gullet constructed about the centre of the embankment, sunk beneath the level of the bog, before the embankment was completed, and the adjacent surface was elevated; a second gullet was built over it, and also disappeared, and a third gullet was built over the second, after the necessary precautions had been taken, and the embankment has since remained firm.

In constructing a road in cutting in bog, after the stuff has been excavated, the surface should be covered with one or more courses of bog sods, and then formed, soled, fenced, and stoned in the usual manner, having previously paid due attention to the drainage.

F. V. C———, A.B., C.E.

*Dublin, 6th July*, 1843.

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## THE CARTOONS—1819, 1843.

It is exactly nine and thirty years ago, when a youth named Henry Ardor was waiting for the mail, which was to carry him from his father's roof and his mother's affections, to London, to try his fate as an historical painter, that an old friend of the family, a very wise and worthy man, and brother of Northcote the painter, came to bid this youth farewell. "Ah, it will never do," said his father. "I hope it will," sobbed his mother. "I am determined it shall," said the youth: his venerable friend shook his hand, and said, "Be sure, my dear young friend, you begin with the skeleton, and study hands and feet, for there is not a painter in London who understands a hand or a foot.[1]

The horn was heard, now dying away, now bursting out as it turned the corner of the street in full view, and the horses were seen, trampling and curbed, the royal coachman, with his white hat and scarlet coat, and the guard, red-faced and important, drove up like lightning, and drew up in style. The youth kissed his sobbing mother; "God bless you," echoed from all the assembled friends in a country town, the door drove home with a slam, the horn again blew, and away rattled Henry Ardor, wrenching his affections, with a spasm that squeezed the burning tears out of his eyes, which scalded his cheeks as they fell.

His love of art was a passion of his being, and had been from his earliest infancy; he had often ridiculed in his native town the tip-toed absurdities of the old portrait school, and had often been corrected by his father for presumption; he had made up his mind to devote himself, with all his heart and all his soul, to reform the design of his country, by mastering the construction of the figure, to take pupils as soon as he was qualified, and if talented, to spread the sound doctrine of beginning with the skeleton, and enforcing that as the basis. He entered London, May 14, 1804, and overwhelmed with the intensity of his great object, he went to the new church in the Strand, and falling on his knees, prayed God for success only in proportion as he deserved it. Remembering the warning of his worthy friend, his application was incessant, so that in two years he produced works which honoured his name; he had been admitted a student at once in the Academy, and greatly benefitted by that excellent school, and such a cluster of genius was admitted at the same time, that the men of that period have been the support, and the reformers of the art ever since. Such was his obedience

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[1] What would he say now?

and his diligence, that he deservedly earned the affection and the respect of all his superiors, and all his superiors lauded him as an example to all other young men. Now though there were and had been eminent men, West, Hussey, Barry and Fuseli, not one of them had so deeply and scientifically mastered the figure, and at that time, 1805, though there always had been lectures on anatomy, the skeleton had never been in the antique, and it was from the repeated entreaties of young Ardor, and his fellow students, and the keeper's repeated remonstrances to the council, that the council at last wisely yielded to the wish.

Ardor soon got into high life, and was the wonder of its coteries—went to four routs of a night—was told by the women he had an antique head, and lay in bed late next day; but finding this species of fascination not conducive to application, by degrees he weaned himself from its fascinating attractions—though if he had waited a year, he would have been utterly forgotten, and "left alone in his glory," as hundreds of Ardors had been before, and will be again whilst that delightful class pursue novelty in preference to excellence. Such was the repute Ardor got in his native town, that a boy named Caution was rouzed to come up: up he came too, drank tea with Ardor, and went away so fired by Ardor's enthusiasm, that the next day he called and said, "I'll be a painter, Ardor."

Ardor loved his art better than himself always, and said, "Caution, if you will, I'll tell you all I know." Caution put himself at once under Ardor, Ardor lent him a plaister hand, his anatomical drawings, admitted him at all hours, made him his friend, his pupil, his companion, and poured forth all he had got himself by hard work; as Ardor said, "If I can advance the art, and reform design, my end will be answered." Caution was a good and moral youth, and was very grateful, and so were Caution's friends. Caution went to Italy, and found all the principles Ardor had taught him of the greatest utility in comprehending the great works he saw. In the mean time Ardor took other pupils, and made them go through the same course: and thought it a good plan if two cartoons could be got up from Hampton Court at the Gallery for the use of his pupils. An influential friend approved of the plan, applied to Lord Farnborough and the late Duke of Sutherland, who in an audience of the King, got leave; and Mr. West was ordered to see two cartoons moved up, as keeper of his Majesty's pictures: and St. Paul at Athens, and the boats, were those Mr. West chose.

The moment the cartoons came to the gallery, Ardor sent in all his pupils, who made chalk cartoons the full size, and such was their excellence, and such their impression in the town, that the crowd was obliged to be stopped, and the doors shut, to prevent injury to Raffael's works. Ardor on this moved the cartoons of his pupils to St. James's Street—gave a splendid private day to the nobility—the Arch-Duke Maximilian came with Lord Aberdeen—all the women of fashion praised Ardor more than ever, and Ardor and his pupils became the fashion of the day, and it was said nothing could stop Ardor's career. Unfortunately Ardor had got very angry with the Royal Academy, where he had educated himself, and shared its favours, and Ardor in his fury against the members of that body, had so provoked them by the truth and exposure of their abuses, that they one and all put their powerful influence against Ardor's attempt to found a school, and they denied Ardor had any merit at all—they abused his pupils—drove Ardor to ruin, and involved two of his pupils in equal ruin with himself. People of fashion did not know why Ardor was so abused, but concluded forty men must be right, and Ardor deserved it; and so they let Ardor alone and forgot his works, and Ardor was four times ruined and four times again on the field, so that at last it was considered, to ruin Ardor, was a folly. During all this time Caution had been in Rome, and having been severely bitten by Germans, who dressed like Raphael, returned to England, with a resolution to bite his old master, and all his friends too; but he found Ardor so high in the public feeling, and so inveterate in sound art, that there was no introducing the new insanity but by biting or burking Ardor, and it was therefore agreed, between Caution and Namby Pamby his friend, that Ardor must be burked as he would not be bitten.

It must be told, that one night in 1812, Ardor was in the house of Lords, and when Lord Wellesley was speaking, he put himself in the attitude of St. Paul at Athens; Ardor thought of the cartoons and of the Vatican, and he looked up and saw the Spanish armada. Ardor directly planned the decoration of the old house, laid a plan before the ministers, petitioned both houses, never ceased persecuting all the authorities—the old house was burnt down—Ardor petitioned for the new, till at last it was resolved the new houses should be adorned—a Commission was formed, Caution became secretary, as he deserved, Namby Pamby gave lectures, and the plan of burking was immediately put in practice, for in the lectures of the one or the reports of the other, Ardor was entirely extinguished. Now this was very hard, for Ardor had fought the battle, when Caution and Namby ran away, and the people said it was a great shame to burke Ardor, whatever might have been Ardor's enthusiasm; but Caution had a great game to play, and as Caution knew the safest game to play is always to go with the current, and Ardor's love of truth being obnoxious to all, Caution burked Ardor as well as his works. In the mean time some people wanted the Germans, as the English could not draw—Ardor opposed it, and these people said, as *they can't draw*, let us make them compete in cartoons! *then* we know they will fail, and *then* no one can object to the Germans coming, who *can* draw. The plan was eagerly seized, cartoons were prepared, the youth of England were suddenly called from their daily habits of getting their daily bread, and the following year produced works, which astonished their enemies, delighted their friends, and settled for ever the question of their genius. Ardor was so delighted to see the realization of all his struggles, this confirmation of the plan he had successfully began twenty-four years before, that he died of joy in the 57th year of his age, and fell a victim to the danger of telling truth to power, under whatever circumstances of provocation.—Hail and farewell to him.

I had a great regard for him, and was very sorry, so I wrote his epitaph out of regard to his memory, but before he died I am happy to say he had completed his remarks on the cartoon exhibition, as well as some valuable observations on fresco and design, which shall appear now or hereafter, as it suits.

EPITAPH.

Here lies the body of

**HENRY ARDOR,**

An English Historical Painter,

Who died in the midst of a desperate struggle to make Sovereign, Legislature and People do their duty to the higher walks of design.

" —— active and nervous was his gait,
And his whole body breathed intelligence."
WORDSWORTH.

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This little romantic history of Henry Ardor was absolutely necessary before proceeding to lay before your readers his remarks on the cartoon exhibition—1st. As to the degree of hope cartoons are justified in generating; 2nd. As to the degree of merit the present exhibition exhibits; 3rd. As to the question of oil or fresco for the houses; 4th. As to what is the style to be chosen either in fresco or oil, and 5th. On the danger of delaying much longer a decided plan of decoration.

1st. As to merit:—

Could the Germans at such a sudden call for specimens of colour, and light, and shadow, and surface, have answered as we have answered this; the one is no more unjust than the other—the Germans know no more of colour, and light, and shadow, and handling, than the English were supposed to know of form: could the Germans have answered the call of colour as the English have answered this?—I reply in a voice of thunder,[2] No! nor any other nation on earth! This, then, is a glory, in spite of the solemn inanities of a timid press!—this is a glory you have achieved, young men, by your own innate bottom. The Rout of Comus (63); Alfred in the Camp; the Death of Lear; St. Augustine; the Skirmish of the Picts; the Plague (138); the Caractacus (84); the Una and Satyrs (10); the Constance; the First Jury; Alfred and the Witan; the Curse (33); and Edward & John (118) entering London, through Southampton; would honour any school in any cartoon contest, in any city in Europe: yet cartoons are a delusive fascination, hardly any hopes raised on cartoons alone have answered expectation; for the practice of the brush is so different from the port crayon, that it may almost be taken as an axiom, that the more attractive the cartoon the less attractive will be the fresco; and I have never found any pupil who made hard over-

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2 Very characteristic of Ardor.]

wrought cartoons, ever display with the brush the most distant symptom of nature, truth, or imitation; the most ridiculous expectations have always been excited, the most unbounded anticipations always put forth. Well, the picture was begun, the hand felt awkward, the colour was muddy, the touch feeble, the effect flat, the power of drawing even became poor, till it could scarcely be credited the work was by the same hand, as the promising cartoon. The artist was entirely justified, when looking at a laboured cartoon of Cammucini, the labour of years, when he said, "And after all this trouble comes a bad picture." The cause principally of this incongruity, is the error of modern Europe, in making cartoons a *means* and not an *end*, like the ancients. The system of overwrought niggle is German and modern Italian; the cartoons of the school of Athens is the thing—indeed Raphael was but twelve years in the Vatican, if six had been occupied with *one* cartoon, how many frescos would he have done? the native spirit of the British school will prevent this waste of time, and their common sense will also prevent their making cartoons an *end* instead of a *means*, and if they thus consider them under this head, there will be no danger of any injury accruing to their power of pencil.

The landing of Cæsar, No. 64, is a head prize, and in my opinion most unjustly—Cæsar is paltry in character, stature, and expression—certainly not the Cæsar of Cicero, Suetonius, Sallust and Bacon; he looks like a Centurion engaged in a squabble. It would be impossible to conceive he was meant to be a great general, the "*præsens divus*," watching the landing of an army; there is no army, there are a few boats in the sight, without order or plan, naval or military!—Who is a furious little ancient Briton darting his spear at?—Why is another pulling down in a fury the rocking horse he rides?—Why is one Roman soldier scrambling up and another down?—What is the meaning of all the scramble?—What authority is there that all the Britons had short arms, short bodies, and bandy legs?—Had they not got knee pans? was not the inner ankle higher than the outer in the ancient Britons?—There is no evidence of a clear comprehension of story, no nature in character, no dignity in action, no drawing, no knowledge of structure, no beauty, no grace, great dash of *conté*, great power of effect, great impudence of execution, but no mastery of form; infinitely inferior to 63, close to its side, and altogether an unaccountable specimen of the system of La Roche's school—the costume school of La Roche—for, of the naked, it is evident, neither master or pupil know much. I am quite astonished, and respectfully enter my humble protest against such an honour bestowed, to the injury and insult of the British school. It is perfect infatuation, and is evidence beyond controversy of the absolute necessity of professors being settled at the Universities, to prevent men of fashion making such decisions. If the general proportions of the human form had been explained at college, it would have been impossible for any men of station to have made such a mistake.

First Trial by Jury (105)—A fine cartoon, composed with ability, but not drawn equal to Alfred and the Danes. Alfred and the Danes, as a work of composition, power, and expression, is admirable, and was fully entitled to one of the highest prizes. No. 128, the Fight for the Beacon, is an admirable, a daring, masterly, powerful, ill-drawn, vigorous group; the student will do greater things—but this stamps him as a man of genius. St. Augustine (100) is a beautiful cartoon, adapted for fresco. Una and Satyrs (10) is as fine a specimen of correct drawing as any school could produce in the world; Una wants beauty of feature and swelling of hip, to touch our hearts. 78, Boadicea haranguing the Iceni, is a beautiful evidence of extraordinary power of handling. 104, Alfred submitting his Code of Laws, is weak in power of drawing, but an excellent cartoon. Caractacus (84) is a very fine work, largely drawn, a little approaching to manner: how superior in dignity to Cæsar! how poetically treated is Caractacus! there are symptoms of a feeling for colour in the head and sky; but I do not anticipate much power of painting; there is no look of touch in the chalk, and occasional feebleness in the drawing—still it is a grand work. 82, A Skirmish between the Picts and Romans, is a magnificent work of art—full of vigour without exaggeration, and power without violence. Think of what cartoons have carried off prizes from this! It is painful. 135, is a fine specimen of pictorial management in a cartoon. 138 is by a boy of 16, and a fine instance of expression, though the convulsive man is overdone. The Death of Lear (26), is a noble work, finely composed; and not overdone in breadth and style.

How easy it is to see the cartoons of painters. I would divide such works into the cartoons of those who know how to paint—cartoons of those who give promise of painting, and cartoons of those who will never paint at all. I fear there are a great many here of the latter character. These are, I think, all the principal cartoons. Yet there is one of Constance on the ground (27), a very fine work, though a little hard—still it is finely correct in drawing and costume—everything is distant, yet in keeping, nothing slurred yet nothing obtrusive; it announces a correct eye, nature, composition, and drawing; it has no prize: how could they prefer Eleanor to this, or Lear, or Alfred in the camp of the Danes, or a skirmish with the Picts, or half-a-dozen others. Really the judges had no difficult task, the gradation of merit is palpable, and surely if the artists had made a respectful stand, many things might have been prevented, which must give the judges pain now. The great error was, coming to any decision before the public had been admitted; this was the practice of Greeks and Romans, viz., always to admit the people before deciding on works of art; had this been done, the pupil of La Roche, amiable as he is, would never have had a first prize, so strongly would the public feeling have been expressed:—in future, it is the safest plan, unless any portion of the judges have a predilection for a particular cartoon, and fear the public, then, it had always better be done with closed doors. Though the country is convinced the names of the judges were a guarantee for honor and integrity, yet they have all the habits of society, so much is done in a pleasant party, so beautiful is the influence of women, such are the concessions due to breeding, that there is no hope of absolute justice unless you admit the people—their voice is the voice within, and after their decision from impulse, politeness is of no avail. I would therefore earnestly recommend in future this to be done, to silence all cant.

The object of the wealthy is amusement; nothing contributes so much to relieve ennui as novelty; and nothing can be newer than a young man they never heard of, producing a work they never saw, or a subject they never thought of before. This is the bane of English society, no youth is ever suffered to mature the talent he displays, by continued kindness; but, the wonder of one season, he becomes the bore of the next, and his mind is tortured and his heart lacerated, at the successive discovery that all the praise bestowed on his works had been for years bestowed upon others who had disappeared, and would be bestowed on those with equal sincerity who had not yet made their appearance; artist or poet, admiral or general, beauty or deformity, all contribute their share in the wonders of the season, which lasts about three months. Whilst this pernicious system is confined to the patronage of *private circles*, it is well enough, for all share the evil and the good; but carried into a *great system of public patronage*, its effect will be deadly in the extreme: if we are to have a succession of wonders, first in cartoons then in carving—one year in glass and the next in fresco, how far shall we be fit to decorate when the houses are ready?—we shall not have advanced one jot, and be as much at a loss five years hence, as we should be now, if Barry was to announce the walls are fit for decoration. When Cornelius was here, he said, "Now is not too early to begin the cartoons!" Two years are past, and no plan is defined; we are trying for genius, as we were then, and as we shall be to the last hour, six years hence. With these tendencies, the following hints may not be useless. Take care you do not waste yourself with experiments, and be glad to get a cheap decorator after all. Take care you do not pursue the discovery of new genius with such keenness, as to fix on a new boy of 16, the last year. Take care, from a desire to give every body a chance, the decoration be not a series of thoughts without basis or connexion. Try no more experiments to prove the incapacity of the British, for every trial will prove they have greater claims to employment than you wish to see. Fix on a plan for decoration as early as possible, and let each individual work, fresco or oil, be but a part of the general development. That the upper classes are sincere there can be no doubt, only the government must not let their delightful and volatile habits intrude on the solemnity and dignity of a plan, which is meant to honour the legislature, the people and the sovereign, and develop to its full extent the hidden and bursting genius of the country.

With respect to the selection of fresco or oil, fresco beyond all question is to be selected for architectural decoration, *provided* the continental principle of superior and subordinates be adopted; but not else, if the Commission wish the country to be saved from disgrace. The same system which ensured the victory of Waterloo, the successful termination of St. Paul's, and will ensure the successful completion of the Houses, viz. a general and officers, an architect and pupils, must be adopted if fresco be chosen; the absurdity of gratifying the democratic independence of British artists, where every one thinks himself able to guide, is ridiculous; all will be confusion—lime, mortar, splash, cut, scramble and failure. I will venture to say the young men do not desire it, and no young men can be more easily led, if their affections are touched, than the British. They have now been fairly brought out, and I hope they will not be deserted; but I advise them, if they have any sub-employment which gives them bread, not to neglect it if they have mothers to maintain, sisters to protect, or relations to help; let them paint quietly what they are wanted to do, so as not to depend on the caprices of governments, keep their independence by honest means, and to remember they have shown more talent than was expected, though *not by me*, and more than was desired by many who longed for their failure.

Now as to the style of design for the walls; must it be in the perfection of art and reality, or must it be the art which was extant when Gothic architecture began? After the Fall, shelter was early as much a necessity as food, hence arose huts and columns, roofs and houses; then leisure and peace generated ornament, and thence arose perfect architecture and its orders. Architecture therefore preceded art, and must have been in a high state, when art was in infancy; but it does not follow that art in infancy is more in character with architecture in perfection, because from causes over which it had no controul, it was in infancy when architecture was perfect! The association may be powerful, but at this time of day, when art in perfect state has been discovered, the association may be rendered as infallible, by uniting perfect art and perfect architecture, as it is now strong in its imperfection. No man will assert the British people were not as handsome when Westminster Hall was built as now;—no one will assert they walked on tip toes, as they were painted, or stared as they were painted, or looked as flat as they were painted at the time;—no man will assert that light and shadow were not as powerful *then* as *now*—that colour was not as brilliant, and forms not as well knit, and if these things are represented on Gothic buildings the reverse, it was not on principle, but ignorance; what absurdity then to go back to the ignorance as if it were principle, instead of boldly breaking the association by making common sense the guide, and giving us Britons as we know Britons were, because if Britons were such poor creatures as they were painted, neither Westminster Hall or Westminster Abbey would ever have been built, conceived or finished.

It may be said there is a limit—*there is*; the florid vulgarity of Rubens would be as unfit as the starved impotence of Cimabue. The cartoons of Raphael appear to me to be the medium, not inconsistent with colour, or light and shadow, form or expression, nature or idea; and to *this* style I earnestly hope the artist will look, independent as it is of the whiskered ferocity of the German, the theatrical pedantry of the French, or the careless neglects of the portrait English.

With the power of drawing, visible in this exhibition of cartoons, nothing need be feared; and the great superiority of the British school in construction and form, to the French school, as exhibited in the pupil of La Roche, is a singular feature. La Roche's pupil was brought over by a noble lord to floor the school, and the school has floored him; the reason is, the British begin by the skeleton and construction, all over the country, and *if they continue*, no school on earth will surpass them; and there is no knowing to what extent they will go, whilst the French, (Ingres and La Roche,) do not investigate construction till boys have got a relish for the brush, and then, anatomy and construction are tedious things! Great honour is due to the academy school, for all I praise are students, and if the present keeper does not permit himself to be *Germanized*, every excellence may be expected still. There is one affectation, which must not be mistaken for a beauty—the competitors, who have been abroad, make a black line round their figures; before tracing for the wall this may be well, but the absurdity of doing such a horror, to show you know it is to be done, is contemptible and pedantic. God keep the British students till the eleventh hour from such a detestable obstruction to rotundity. The desire people of fashion have for what is new, is a danger to be guarded against by the Commission; the chances are, if the plan of design be not soon settled, and the artists set properly to work, when the walls are ready, the whole may fall into the hands of young men, for the sake of giving them a chance, as it is said, and the whole thing become a ridicule from the most generous feelings. It cannot be too often repeated, that the caprices of the cliques of fashion, who have regularly, with the kindest intentions, flattered and entrapped, deserted and ruined, a succession of generous youths, who believed all they were told, till poverty undeceived them, should not be permitted to gain ground, in the dignity of public patronage, for nothing will be the result, but crude experiments without hope, and futile consequences without genius; the government finding the public money wasted in vain, will become hopeless of raising art, or improving the people, and that honourable members may be no longer annoyed, will hurry the affair into the hands of some hasty decorator, who glad of a job will do it cheap, and render Briton again the bye word of some future Winkleman, or some future Du Bos, and ages will again pass without such another moment.

HENRY ARDOR.

Here my dear friend left off; and I must add, what I am sure every reader will agree to.—God keep us from such a misery. If I find any more papers of my late dear friend, Mr. Editor, I will regularly forward them, and beg to say I am,

ARDOR'S EXECUTOR.

P.S. I am quite sure if anything goes wrong in the commission, I shall be honoured by a visit from Ardor's ghost, from which Heaven defend me.

## PROCEEDINGS OF SCIENTIFIC SOCIETIES.

### INSTITUTION OF CIVIL ENGINEERS.

*March* 21.—The PRESIDENT in the Chair.

"*Description of the Blast Furnaces and of the Barrow used for filling the Charges of Mine and Coke into them, at the Butterley Iron-Works, Derbyshire.*" By S. C. Kreeft, Grad. Inst. C. E.

The three smelting furnaces described in this communication are situated at Butterley, in Derbyshire; and three others, belonging to the same proprietors, exist at Codnor Park Forge, about 2½ miles distant, where their produce is converted into malleable iron.

In the internal form or dimensions of these furnaces there is not any peculiarity; the diameter over the hearth is 4 feet, over the boshes 15 feet, and at the charging-plate 8 feet—the total height being 45 feet.

The stacks, however, differ from the ordinary form in their external construction. The base of each is 40 feet square, battering inwards at an angle of 71° (3 inches to 1 foot); the quoin-stones and course work being laid at right-angles to the battering line, or at angle of 16° with the horizon. Instead of the usual semicircular arches over the tuyeres, pointed Egyptian arches are substituted, and an open vertical joint or separation in the masonry is left from the apex of the arch up to the top of the stack on all the four sides. This is done for the purpose of obviating the evils generally arising from the expansion and contraction of the stack in heating and cooling, from which the keystone of the semicircular arch usually falls, and the work cracks all around. With the pointed arch, the vertical joint in the masonry merely opens from the heat, and in contracting resumes its former position, without any injury to the other joints of the masonry or deranging any of the archstones. The stacks are confined in the usual manner by wrought-iron braces, 2 inches diameter, built into the walls, with washer-plates and cotters at the extremities.

The mode of filling or supplying the materials into the furnace is particularly described: it is by means of a circular barrow of wrought iron, running on four wheels, the shafts by which it is guided, being so arranged as to form a steel-yard balance for weighing the contents of the barrow; the bottom is conical, and is capable of being raised or lowered by a rack and pinion, which is worked by a rod placed between the shafts, so that when the workman has pushed the barrow over the furnace-mouth, he can, by turning a handle, lower the conical bottom and distribute the materials equally around the interior periphery of the furnace. This regularity in depositing the materials is of importance to the good working of a furnace, and would alone render the barrow an improvement on the ordinary mode of filling, but it is also found to be more economical in every respect.

The charge for good forge pig-iron is—

| | |
|---|---|
| Coal .. .. .. .. .. .. | 9 cwt. |
| Argillaceous iron ore from the coal measures .. | 10½ „ |
| Calcareous ore from the Peak of Derbyshire .. | 2 „ |
| Limestone .. .. .. .. .. .. | 3 „ |

Four and a quarter charges produce 1 ton of iron, or 38 cwt. of coal to 1 ton of iron.

The average produce of each furnace is from 90 tons to 120 tons per week.

The average results of yield of the furnaces may be taken thus:—

| For the Years .. .. | 1839. | | | 1840. | | |
|---|---|---|---|---|---|---|
| | Tons. | cwt. | qr. | Tons. | cwt. | qr. |
| Calcined mine used .. .. .. | 18,484 | 7 | 3 | 19,521 | 19 | 2 |
| Peak ore used .. .. .. .. | .. | .. | | 676 | 16 | 0 |
| Average mine used per ton of iron | 2·76 | 0 | 0 | 2·66 | 0 | 0 |
| Limestone used .. .. .. .. | 6·794 | 15 | 3 | 6·694 | 0 | 1 |
| Average limestone per ton of iron | ·99 | 0 | 0 | ·88 | 0 | 0 |
| | Tons. | Tons. | cwt. | Tons. | cwt. | |
| Average quantity of coals per ton of iron, No. of charges 5·26, or | 2·37 = | 2 | 7 | 2 | 4 | |
| Coal to blast engine .. .. | ·45 = | 0 | 9 | 0 | 7½ | |
| „ to heating blast .. .. | ·25 = | 0 | 5 | 0 | 5½ | |
| „ to calcine mine .. .. | ·40 = | 0 | 8 | 0 | 9 | |
| Tons .. .. | 3·47 or | 3 | 9 | 3 | 6 | |
| Quantity of metal made .. | 6,822 | 5 | 0 | 7,630 | 3 | |

Three of the furnaces are blown with air, heated to about 680° Fahrenheit.

The engine has a blowing cylinder of 80 inches diameter, with 8-feet stroke, discharging 558 cubic feet of atmospheric air at each stroke, under a pressure of 3 lb. per square inch, or about 7800 cubic feet per minute; the diameters of the nozzles of the blast-pipes vary from $2\frac{3}{4}$ to 3 inches, according to circumstances.

The principal dimensions of the furnaces are given, and the communication is illustrated by two drawings of the furnace and the barrow, in plan and elevation, with details of construction.

## AUTOMATON BALANCE FOR WEIGHING COIN.

"*Description of the Automaton Balance for weighing Coins, invented by William Cotton, Esq., Governor of the Bank of England.*" By Thomas Oldham, Assoc. Inst. C. E.

The paper first gives a brief notice of a portion of the bullion transactions of the Bank of England, in order to explain the difficulties which led to the invention of the machine. The new coinage first arrives at the Bank from the Mint in what are called "journies," a single journey weighing 15 lb., and containing 701 sovereigns. The officers of the Mint are allowed 12 grains plus in every pound-weight of metal, for the irregularities incidental to working it into coin, but they usually work to within half that allowance, which is technically called "the remedy."

There have been coined for the Bank lately 8,000,000 of sovereigns, and the greatest variation from the weight allowed was only 60 grains, or one-third of the remedy: each sovereign should contain a portion of this remedy, to allow for wear in public use, and this extraordinary subdivision of the metal is invariably obtained. The usual delivery of new coinage at the Bank contains 100 journies, which is counted by weight only—that is, 200 sovereigns are counted into one scale, and the rest of the delivery is weighed in parcels which balance these 200, and this is all the counting the new coinage receives. The regularity and precision of the manipulations at the Mint obviate the necessity of any further examination, either as regards the gross amount or the weight of an individual piece.

When the currency returns to the Bank from the public it becomes necessary to ascertain if it has been reduced below the standard weight, and this imposes an arduous duty on the officers of the Bank. The amount of gold paid daily over the Bank-counter varies considerably, but 30,000 may be taken as a rough average, and hence arises a tedious, irksome, and expensive process in weighing so large a number of pieces singly and in quick succession, separating, at the same time, the light from the standard coin.

The mode of weighing coins by hand requires much dexterity, practice, and attention; but, in spite of all these, errors were inevitable, and it was to obviate these that the machine was invented by Mr. Cotton, the Governor of the Bank of England: it was constructed from his plans, by Mr. Napier, (of York Road, Lambeth,) and is thus described:—Its exterior presents a plain brass case, with a small hopper tube on the top plate, about $4\frac{1}{2}$ inches from which there is an opening in the top plate. In this opening is seen a platform in the form of a quadrant. This platform is suspended above one end of the beam, and is to receive the coin to be weighed. On one side of the case is a till—to receive the sovereigns as they are weighed—partitioned so that one division is left for standard coin, and the other for such as are light. There is a sliding door to each division, for removing the coins at pleasure. The machine may be worked like a clock, with a weight, or by any simple application of power.

Its visible action is as follows:—The hopper being filled with gold, upon setting the machine in motion, it immediately places a sovereign on the little platform which serves, as already stated, in place of a scale-pan, and if it is of standard weight, a small tongue comes rapidly forward and pushes the sovereign into that side of the till allotted to such coin; if light, another, and similar tongue to the first, pushes the sovereign into the other side of the till. The action of these tongues is at right angles to each other. While a sovereign is being weighed, a succeeding one is on its way from the hopper to the platform, and the moment the preceding sovereign is disposed of, according to its value, another is placed in its stead. To keep the hopper supplied with gold, and remove it from the till as it is filled, is all the attendance necessary.

The more minute parts of the mechanical arrangement of the machine, such as the fulcrum, the forceps, &c., are described in detail, and the following statement by Mr. Miller is given, as a comparison with the old method of weighing:—"With the bullion-scales 4000 may be stated as the number a person can weigh in six hours. As the sovereigns now tendered at the Bank-counter are most of them new, the scale dips quickly in weighing, and one person can weigh 5000 in six hours; but a short time ago, before the issue of the new coinage, the same person could only weigh 3000, as it took a longer time for the scales to indicate. The bullion-scales cannot indicate nearer than $\frac{4}{100}$ths of a grain at the above rate. The machine is perfectly free from the sources of error to which the scales are subject, and weighs as quickly, whether sovereigns are new and of full weight, or old and doubtful; it can weigh 10,000 in six hours, and divide coin varying only $\frac{1}{50}$th of a grain."

The paper is illustrated by two drawings of the internal arrangement of the machine, and a model showing the action of the tongues and platform.

*Remarks.*—Mr. Oldham exhibited the automaton balance at work weighing coin; and after describing, with the aid of a diagram and model, the action of some of the more delicate parts of the machine, he observed that in seeking to obtain extraordinary performances by machinery, mechanical propriety of construction was too often overlooked, and premature deterioration in the action of many parts was the result. The automaton balance was peculiarly worthy of notice from the judgment exercised in its relative proportions, as was proved by the fact that, after being at work for several months, it had become more delicate in detecting slight variations between standard and light coin than when it was first constructed. Mr. Cotton's object in this invention should be well understood. Public convenience demanded great accuracy in weighing the currency; by the ordinary mode of weighing gold with the bullion scales—although it was due to the bank-tellers to state, that they gave the utmost attention to their monotonous duty—it was nearly impossible to guard against the various difficulties detailed in the paper. The injury sustained by the optic nerve, from constantly watching the indicator of the scales, was a serious inconvenience to the operative, which, coupled with the incidental sources of error referred to, created even greater absence of delicacy than the paper stated. Errors to the amount of one-third or even half a grain were not unfrequent. By the "automaton balance," the number weighed in a given time was increased, and undeviating accuracy obtained. The delicacy of the instrument was such, that from 30 to 35 coins per minute could be passed through the machine, detecting a difference of only $\frac{1}{50}$ of a grain. It should be mentioned that much greater delicacy could be accomplished, that is, to the $\frac{1}{100}$dth of a grain, but not at the same rate; because it would be understood that a slow action of the beam was necessary for very small variations, and that must regulate the speed of working; but such delicacy was beyond all useful purposes in those transactions which it was intended to improve.

Mr. Cotton said that his attention had been attracted to the point by the inconveniences to which the "tellers" were subjected in weighing gold for the public: with balances so delicately constructed as the bullion scales, the agitation of the air by the sudden opening of a door, or even by the breathing of those around, sufficed to cause errors. It was possible, also, by pressing the fulcrum against the bridle, to produce such a degree of friction as materially to interfere with accuracy; and the tellers confessed, that after weighing two or three thousand coins the sight was injured, and they no longer observed with the same degree of correctness. He therefore imagined that a machine might be contrived, which being defended from external influence, might weigh coins as fast as by hand, and within one-fourth of a grain; but he certainly did not contemplate attaining such perfection as the machine now possessed. His first idea was, that the light coins should be taken off by a forceps, and that those of average weight should be pushed off by the succeeding ones; but it was found, that the slightest inaccuracy in the milled edges sufficed to give them a wrong direction: therefore, when he made the first rough sketch, and consulted with his friend, the late Mr. Ewart, he recommended that Mr. Napier, of York Road, Lambeth, should be employed to make the machine, and to him was due the suggestion of the two alternately advancing tongues, as well as several other arrangements of the machinery, which he had so successfully constructed. When the first machine was tried, out of 1000 sovereigns, 160 were found to be light. They were given to a teller to be verified, and he returned several of them as being of the proper weight; but upon again weighing them more carefully, the result given by the machine was found to be correct. As an instance of how many circumstances should be taken into consideration in delicate machines, he might mention that, after being used for a time, the machine varied in its results, and on examination it was discovered that the end of the lever, which traversed the pendant, had become magnetic, and thus affected the balance. An ivory end was substituted, and ever since that period its accuracy had been maintained.

Mr. W. Miller observed, that the efficiency of any scales must be determined, in a great degree, by the fineness of the edge of the fulcrum of the beam; and it would be easily imagined that the friction, to which the edge in a pair of bullion scales was subjected whilst weighing five or six thousand sovereigns per day, must soon impair its delicacy, and consequently the efficiency of the whole apparatus: for, whether the sovereigns were light or heavy, the beam must turn upon its fulcrum. Such was not the case with Mr. Cotton's machine: its beam did not act at all, unless a light sovereign was placed upon the platform; so that among 1000 sovereigns, if only 100 were light, the beam of the machine would only move 100 times, while that of the ordinary scales would oscillate 100 times. An immense advantage was thus given to the machine in point of durability. All weighing was but an approach to correctness, and the nearest point to which the best kind of common scales were sensible, might be stated as $\frac{3}{100}$ of a grain, and one-fourth of a grain would hardly cover their errors; but the machine was sensible to $\frac{5}{1000}$ of a grain, and $\frac{3}{100}$ would fully cover its errors, which were not a twentieth part so numerous as those of the scales.

### Woollen Factory for Turkey.

Mr. Fairbairn exhibited a model, showing the plans, sections, and architectural elevation of a Woollen Factory, to be constructed of cast and wrought iron, near the town of Izmet (Turkey), for the Sublime Porte.

Mr. Fairbairn said that, in 1839, he visited Constantinople under the instructions of the late Sultan Mahomed, and reported upon nearly all the government works. Their extension was checked by the death of that prince, but the present Sultan was disposed to carry them into effect, and by his orders Mr. Ohanes Dadian had arrived in England, in furtherance of the plans for ameliorating the state of the Turkish community by introducing useful arts and manufactures, in which he was aided by his Excellency Ali Effendi, the ambassador to the court of England, and the consul-general, Mr. Edward Zohrab. Almost all the houses, and many of the public buildings, in Turkey, being constructed of timber, destructive fires were frequent. In many parts of the country the common building materials were expensive; iron had therefore been resorted to for construction, and Mr. Fairbairn had already sent over an iron house for a corn-mill, 50 feet long, 25 feet wide, of three stories in height, and with an iron roof. It was finished in 1840, and erected at Constantinople in the succeeding year. The success of this attempt induced a second order, which was for an extensive woollen factory, to be composed entirely of cast iron plates, the interior being formed throughout of brick arches, upon cast-iron columns and bearers, with an iron roof. He then described in detail the construction of the different parts of the building, and the machinery, which would be driven by a fall of water of 25 feet in height, of the computed average power of 180 horses. Several ingenious devices were described for preventing any objectionable effects from the high conducting power of the metal. The piers between the windows were hollow, so as to admit a current of air through during the hot season; and the iron roofs were so arranged as to have beneath them a coating of plaster, to serve as a non-conducting substance. The two principal rooms were described to be 272 feet long, 40 feet wide, and 20 feet high; and 280 feet long, 20 feet wide, and 20 feet high: with a great number of other rooms, for the several processes in the manufacture of coarse woollen cloths, for the counting-houses and departments of the directors, and for the reception of the sultan, &c. The area of the inclosed surface, including the court-yard and buildings, was nearly 3 acres, or 110,621 square feet.

The floor surface in the basement rooms = 16,480 square feet. Ditto in the upper rooms = 54,616 square feet.

*March* 28.—The President in the Chair.

### Cast and Malleable Iron.

"*Experiments upon Cast and Malleable Iron, at the Milton Iron Works, Yorkshire, in February*, 1843." By David Mushet, Assoc. Inst. C. E.

The blast furnaces at Milton had been for a long period worked with heated air, generally under a pressure of 3 lb. per square inch, and each with two nozzles on the blast-pipes of $2\frac{1}{2}$ inches and $2\frac{9}{16}$ inches in diameter. The apparatus requiring to be renewed, a quantity of iron was made by cold-blast, which, as the materials or other circumstances of manufacture were not in any way changed, offered an opportunity of testing the relative strength of the two sorts of iron, of which Messrs. Graham and Co., the proprietors, took advantage, and secured the assistance of Mr. Mushet to conduct the experiments. A strong wooden frame was erected, upon which were fixed iron supports at 4 feet 6 inches apart, for sustaining the bars to be proved. A bar of iron planed perfectly true, with a dove-tailed groove and a graduated brass scale in it, was used for ascertaining the deflection. The bars to be experimented upon were all cast alike, 5 feet long and 1 inch square, and cooled with equal precaution. The results are given in a series of tables, of which the following are the average results:—

| Table. | No. of Experiments. | Quality of Iron. | Specific Gravity. | Breaking weight in lb. | Deflection in inches. | Impact. |
|---|---|---|---|---|---|---|
| 1 | 12 | No. 4. Cold-blast iron re-melted in the cupola, mottled or approaching to white . . . . . | 7·153 | 442 | ·9418 | 427 |
| 2 | 12 | Same iron re-melted in the cupola with an increased quantity of coke produced gray iron | 7·054 | 435 | 1·1916 | 519 |
| 3 | 12 | No. 3. Hot-blast iron re-melted in the cupola . | 7·012 | 520 | 1·542 | 782 |
| 4 | 13 | Nos. 3 and 4. Hot-blast iron re-melted in an air-furnace with coal . . | 7·107 | $610\frac{1}{2}$ | 1·532 | 940 |
| 5 | 10 | No. 1. Hot-blast iron cast from the blast furnace. | 7·012 | 439 | 1·56 | 686 |
| 6 | 12 | No. 3. Ditto ditto . . | 7·046 | 439 | 1·43 | 630 |

The result of these tables are examined, and among the deductions drawn from them are—that the Milton cold-blast iron is rather deficient in strength; that the hot-blast iron is stronger than cold-blast, when re-melted in a cupola with coke; that hot-blast iron from the furnace is equal in strength to the average of the two sets of specimens of cold-blast re-melted in the cupola; that the No. 3 iron from the blast furnace is not stronger than No. 1 quality. The general results show, not only the superiority of the Milton hot-blast iron over that made by cold-blast, at the same furnaces, but over that of a very large number of works, as shown by the following comparative table taken from Mr. Fairbairn's report in 1838:—

| | | | | lb. |
|---|---|---|---|---|
| Milton, | hot-blast iron, | No. 3 | Air furnace | $610\frac{1}{2}$ |
| Ditto, | hot-blast | „ 3 | Cupola | 520 |
| Ponkey, | cold-blast | „ 3 | | 581 |
| Bute, | ditto | „ 1 | | 491 |
| Windmill End, | ditto | „ 2 | | 489 |
| Old Park, | ditto | „ 2 | | $485\frac{3}{4}$ |
| Lowmoor, | ditto | „ 2 | | 472 |
| Buffery, | ditto | „ 1 | | 463 |
| Brimbo, | ditto | „ 2 | | 459 |
| Oldberry, | ditto | „ 2 | | 455 |
| Adelphi, | ditto | „ 2 | | 449 |
| Blaina, | ditto | „ 3 | | 448 |
| Devon, | ditto | „ 3 | | 448 |
| Frood, | ditto | „ 2 | | 447 |
| Milton, | ditto | „ 4 | | $438\frac{1}{2}$ |
| Elsecar, | ditto | „ 2 | | 427 |

The waste in re-melting the hot-blast iron was under 2 per cent.

| | Cwt. | qrs. | lb. |
|---|---|---|---|
| There was charged in the cupola, No. 3, pig-iron . . . | 20 | 1 | 0 |
| Pigs and scraps obtained . . . . . . . | 19 | 3 | 14 |
| | | 1 | 14 |

The results of the experiments upon malleable iron made from hot-blast pig, and plate, show extreme ductility, when subjected to blows of a hammer 24 lb. weight, of which one example will suffice. A bolt $2\frac{1}{4}$ inches diameter, puddled from refined metal, notched half round to the depth of one-eighth of an inch, required 120 blows to break it.

*Remarks.*—Mr. Cottam remarked, that the paper would have been more satisfactory, if it had stated more particularly the progressive additions of the weights, the intervals of loading, and the length of the periods during which the bars remained loaded. He had found that when a beam was near the point of fracture, if the weights were added quickly, it would apparently bear more, than if a certain time was suffered to elapse between their application. His practice in experimenting was to make small additions of weight, at given intervals, which might be increased in length toward the point of fracture; more correct results were thus obtained.

Mr. Lowe believed, that in making iron, the main consideration after selecting good materials, was to proportion them according to the hygrometric state of the atmosphere. It was well known that better iron was made in frosty weather than in damp warm weather; and he was convinced that the more air was deprived of its moisture, the better would be the effect.

Mr. Parkes observed, that the experiments on the strength of the wrought-iron bars could scarcely be received as conclusive, as the power employed had been variable and ill-defined. If a given weight had been allowed to drop from a certain height, and the incisions in the bars had been made with precision by a machine, the power required to produce fracture could have been easily calculated, as regarded the impact.

Mr. Farey observed, that notwithstanding the difference between the results recorded in the paper, and those arrived at by Messrs. Fairbarin and Hodgkinson, he was inclined to place confidence in them on account of Mr. Mushet's known accuracy as an observer. He thought that the disrepute into which hot-blast iron had fallen was unmerited, that it was occasioned by want of care, and the use of inferior materials in the manufacture. He considered Mr. Neilson's invention a most important improvement in metallurgic operations, but it had been abused because, by its means, ores which were formerly difficult of reduction, and therefore thrown aside, had since been economically fused, without due regard to their chemical constitution, and the metal produced was variable in quality and sometimes deficient in strength. Nevertheless, Mr. Mushet's experiments showed that when proper care was exercised in the selection of the materials, and in the working of the furnace, the Milton hot-blast iron, when re-melted in the air-furnace, attained the high breaking weight of 610½ lbs., which was greater than that of the best specimens of cold blast iron. Mr. Farey then described at length the chemical combinations which occurred in the blast furnace. The general result was, that the use of hot-blast accelerated the process of separating the oxygen from the ore, and of replacing it by carbon, rendering also the subsequent fusion more rapid and complete. A great advantage was obtained by avoiding the cooling effect, which was formerly produced by the introduction of a quantity of cold air under pressure: the point of fusion was higher up in the furnace, and the quality of the metal, when it fell into the hearth, was not injured by being blown upon, as it was protected by the covering of liquid slag at a high temperature which descended upon it. The deoxydation and absorption of carbon being facilitated, the metal contained a redundancy of carbon, notwithstanding a less quantity of fuel was consumed. It was probable that the want of strength sometimes observed might arise from the imperfect amalgamation of the carbon with the metal, and this would account for the strength being increased by re-melting, particularly in the air furnace, wherein the process was more gradual than in the cupola. This gradual process was not desirable for cold-blast iron, in which the carbon was already well distributed; therefore in almost all foundries. the air furnaces had been replaced by cupolas, as in the latter the iron was melted much more rapidly. When the use of hot-blast was first proposed, it was supposed that it could not answer, because in all furnaces, better iron was generally made in the winter than in the summer. This was a fallacy which ought not to have been entertained, as it was well known that the good working arose from the dryness of the air in the winter, on which account the water-regulators for the cold-blast were generally abandoned, and large dry reservoirs, with or without floating piston regulators, were erected in their stead.

Mr. Field corroborated Mr. Farey's statement of the iron, when re-melted in an air furnace, becoming hard and brittle. He had in consequence abanboned their use, and made even the heaviest castings from cupolas. He attributed the deterioration of the iron to the slowness of the process of melting in the air furnace. He had found the No. 1 hot-blast pig-iron too rich and weak for general purposes; the No. 3 generally possessed the greatest strength.

Mr, Rennie, in answer to a question put by Mr. Farey, said, that in his experiments, the transverse strength was 750 lbs.; and when the bearings were 3 feet apart, the strength was 897 lbs., with specimens of good quality.[1] He believed that in some experiments on iron made with anthracite. published by Mr. Mushet in 1836, the cold-blast iron was shown to be from 16 to 27 per cent. stronger than that made by the hot-blast process. This might have arisen from peculiar circumstances, as Mr. Crane, of Ynischedwyn, had shown him a pig of hot-blast iron, which had resisted upwards of a hundred blows of a sledge-hammer, while the ordinary cold-blast pigs were generally broken by about a dozen blows. From the discrepancy shown by the various experiments, he was inclined to think that the knowledge of the real effects of heated air, in reducing metallic ores, was at present very limited.

Mr. W. Brunton said that the only place where iron had been made with anthracite and cold-blast was at the Ystalyfera works, South Wales; and the report by Mr. Mushet, which had been alluded to, was upon the iron made there. The black band iron-stone had recently been found at the Beaufort iron-works, South Wales; and as the furnaces were now blown with heated air, a large quantity of good soft iron was produced. That mine had been tried in the raw state, but the result had, he believed, been doubtful.

Mr. Davison submitted that the want of strength, which was complained of in the hot-blast iron, might in some degree arise from the use of raw coal instead of coke in the blast furnace, as the sulphur and other deleterious matters, which were formerly got rid of in the process of coking, were now introduced to the furnace, and probably combined with the iron.

Mr. Vignoles agreed with Mr. Lowe, that the hygrometric state of the atmosphere had much influence on the quality of the iron produced. It was found in India that even with the rich hæmatite ores and charcoal, which were solely used by the native workers of metal, good iron could not be made when the air was charged with moisture; but that during the hot dry winds the best metal was produced.

[1] Phil. Trans. 1818, p. 133.

Mr. Carpmael said, that during a recent visit to the Ystalyfera iron-works. he had tried some experiments on the strength of the iron then being made, The bars were 1 inch square, placed upon bearings 4 feet 6 inches apart, and were carefully and gradually weighted, the deflection being ascertained by an apparatus for the purpose.

No. 1 specimen, loaded with 588 lbs., deflected 1½ inch, and sprung back when unloaded without any permanent set. The weights were replaced, and additions made up to 690 lbs., at which point it broke.

No. 2 specimen, with 660 lbs., deflected 1½ inch; with 718 lbs. it deflected 1⅞ inch, and broke with 742 lbs.

No. 3 specimen, with 578 lbs. deflected $1\frac{4}{10}$ inch; with 634 lbs. it deflected $1\frac{5}{10}$ inch, and broke with 774 lbs.

At the Ynischedwyn works, where hot blast and anthracite were used for smelting the ore, the pig iron exhibited greater strength than any Scotch iron that he had ever seen. It appeared to him that, in the Scotch iron-works, the object was to produce a large quantity of metal without due regard to its quality.

Mr. Parkes remarked, with reference to the experiments upon wrought iron, that the test by blows of a hammer was not sufficiently substantive to be received as authority for the actual strength of iron: it frequently occurred in practice that bar iron, which, when tried by breaking on an anvil, exhibited brittleness after being forged by a smith, had proved tough and good. Neither did he conceive that the capability of a beam to sustain a given weight suspended from its centre was a proof of its fitness for resisting impact, torsion, and other strains to which machinery was subjected. On these grounds he did not receive the experiments either of Mr. Fairbarn or Mr. Mushet as satisfactory, or as true indications of the absolute strength of the iron. A mode of testing should be introduced, which would show whether the improvements in making iron affected the quality of the metal produced, or whether they were restricted to charges in the method of manufacturing.

Mr. Farey remarked that, in Mr. Fairbairn's experiments, the deflection had been carefully noted, and the power of resisting impact had been calculated by multiplying the breaking weight in pounds into the ultimate deflection in inches.

Mr. May regretted that, upon the subject of such importance as the manufacture of cast iron and its capabilities, so little positive information was recorded. The field for scientific inquiry was very extensive, and although many men of high attainments had entered upon it, at present the results were not satisfactory: this, he believed was only to be accounted for by the fact, that the habits of mathematical investigation of the experimenters, had led them to examine the theoretical rather than the practical part of the subject. His experience of Scotch hot-blast iron, induced him to declare it deficient in strength and tenacity, but it did not follow that all hot-blast iron should be bad; on the contrary, he believed the process to be a great step in metallurgical science, from which important results would be obtained; but it had unfortunately afforded an opportunity for working up inferior materials, to the manifest detriment of the founder and the engineer. If, however, at present such was the result, it was to be hoped that the attention of manufacturers being directed to the point, an amelioration would be speedily introduced, and to this the discussion by the members of the institution might materially contribute, and thus a great benefit would be conferred on the mechanical world.

Mr. Mackain objected to the condemnation of Scotch hot-blast iron, as he had found much of it fit for general purposes, although it was not so strong as that made with cold-blast.

Mr. Ransome corroborated Mr. May's opinion of Scotch iron. It was so weak that the pigs frequently broke in unloading; it was necessary to mix a large quantity of old iron with it, in order to give the castings for machinery the requisite amount of strength.

Mr. Nasmyth had used great quantities of Scotch iron, both for large and small castings, and could not rely upon it for machinery: it was deficient in strength, and the contraction of the metal in cooling was so great as to cause frequent losses to the founders who employed it. Indeed he conceived that nothing but the lowness of its price had caused it to be so extensively used; yet, in his opinion, this reduced commercial value marked its inferiority for there must exist some good reason why hot-blast iron should only sell for 45*s*. to 50*s*. per ton, when cold-blast iron cost 80*s*. or 90*s*. He had for a long time used but little of it, and that only to mix with the harder qualities of iron. He did not attach much faith to experiments tried upon bars of such small dimensions, and merely by suspending weights to them. He was of opinion that the masses of iron should be of larger dimensions, and that they should be tried under similar circumstances to those under which they were intended to be used.

Mr. Davison said, that some years since, the framing for supporting one of the large vats at Messrs. Truman and Co.'s brewery, weighing 100 tons when full, had been cast of cold-blast Welsh iron, and had stood well to the present time; but that of a precisely similar set of castings made from Scotch iron, two girders had broken the first time the vat was filled.

Mr. Field stated that the high character which had been obtained by the guns from the Carron Foundry was to be, in a great measure, attributed to the care with which the iron employed was selected and mixed. A simple method was in use there for ascertaining the comparative strength of different qualities of iron, and had been found perfectly satisfactory for practical purposes. A wrought iron bar. 1 inch square, was bent into a deeply indented serpentine or zig-zag figure, having three or four bends, each end of the bar terminating in an eye. This was used as a pattern, from which several serpentines were cast at each running of the blast furnace; they were suspended by the upper eye, and a scale being attached to the lower one, weights were gradually added until the castings broke. Such a figure was fractured with very little weight, and the method did not afford any test of the actual strength of the metal; but it was simple, and as the foundrymen could conduct the experiment, it enabled a correct opinion to be formed of the comparative strength of the different kinds of iron under trial, and to make the necessary mixture. The system was used in his foundry whenever new kinds of iron were purchased, and he obtained good results from it.

## ROYAL INSTITUTE OF BRITISH ARCHITECTS.

*June* 26, 1843.—Mr. Britton gave an essay on the fine Anglo-Norman Porch to *Malmsbury Abbey Church*, which was illustrated by several drawings. He also referred to, and made incidental remarks on several other Christian porches, comparing and contrasting them with the famed Grecian and Roman Porticos of Pagan architecture. The subject afforded scope for interesting criticism, and was well calculated for a large auditory of young architects. We fully agree with our veteran antiquary in reprobating the absurd and tasteless practice of copying and applying, or rather misapplying, the portico of a Greek or Roman temple to a modern chapel, church, theatre, and common street house, when perhaps no other part of the building has a classical feature; and certainly the whole has no analogy, either in purpose, scenery, or association to ancient eastern edifices. It would be as congruous and correct to place the counsel's, or bishop's, wig on the sconce of the chimney-sweep or dustman; on the contrary, the porch can be applied with harmony and propriety to almost every variety of building—from the church to the workhouse, from the palace to the cottage. Mr. Britton exemplified this very forcibly, and justly, by referring to many diversified examples in England, and also commented on the great varieties of edifice which the monastic architects of the middle ages designed and erected for the use of their contemporaries, and for the admiration of their descendants. The following were particularly noticed:—those attached to the cathedrals of Salisbury, Wells, Ely, Peterborough, Lincoln, Gloucester, Hereford, &c.; also to many in parish churches and chapels, particularly to the unique and extraordinary double porch on the north side of Redcliffe church, and to those of Taunton, Grantham, St. Mary's at Bury, Bishop's Cleve, King's College chapel, &c. His illustrations and comments were, however, more immediately directed to the north Porch of Malmsbury Abbey church in Wiltshire, which he has partly illustrated and described in his "Architectural Antiquities, vols. I. and V., and also in his "Dictionary of the Architecture of the Middle Ages." We quote part of the description of this bold and highly adorned architectural appendage to a church, which must have been originally, when in a perfect state, one of the finest and most impressive Anglo-Norman edifices in the country.

"The door-way, with the whole of the porch, may be referred to and considered as constituting the finest specimen of Anglo-Norman architecture in England. I believe it is unparalleled in arrangement, in elaborate sculptured details, and in its whole design. A large receding archway, with a series of eight mouldings, which extend from the base on one side to the base on the opposite side, are all covered with sculptured enrichments of varied design. Some of the patterns resemble those in Greek architecture and on vases. They are scroll, diamond, and oval-shaped frames, inclosing groups of human figures, animals, &c., intended to delineate passages from the bible and the testament. A label, or hood moulding, with serpent's heads at each extremity, encircle the arch. Within this archway is a large square room, or vestibule, having a stone seat at each side, with columns attached to the walls; a series of arcades, two compartments of bold alto-relievi, representing the twelve apostles, seated on two benches, and two figures apparently flying over their heads. The ceiling was vaulted and ribbed; and, opening to the church there was a smaller doorway, with a profusion of sculptured ornaments, and a basso-relievo of the Deity, or the Saviour, with incensing angels on the lintel. On the right, or eastern side, of this doorway was a piscina, and above the ceiling was a room, with a fire-place, for a monk or porter, who had charge of the church."

*July* 10.—This evening was occupied by reading the Prize Essay, "Are Synchronism and Uniformity of Style essential to Beauty and Propriety in Architecture," by Mr. Chamberlain, for which the medal of the Institute was awarded.

On Monday evening, the 24th July, the session closed, with a full attendance of members and visitors. Mr. Donaldson read a paper on the domestic architecture of the Belgian cities, illustrated by numerous drawings, displaying the peculiarities of the street buildings of Flanders during the middle ages, as compared with our own. The more general use of stone and brick in the Belgian houses of this class forms one striking contrast with those of England in which timber was, with few exceptions, the principal material.

Mr. Maugham explained Mr. Payne's patent process of saturating timber with sulphate of lime for preserving it from dry rot.

Mr. Tite, V. P., who occupied the chair, closed the session with some observations on the progress and prospects of the Institute, and on the state of architecture as an art, on which he took occasion to make some remarks on the present tendency to an abuse of the Gothic style.

## ORNAMENTAL GLASS.

Charles Robert Ayers, of John Street, Berkeley Square, architect, has obtained a patent for improvements in ornamenting and colouring glass, earthenware, porcelain, and metals.—Patent dated July 23, 1842. Specification enrolled January 23, 1843.—If the surface of the glass, earthenware, &c., is to be covered with a plain ground, it is first to be coated with some adhesive substance, such as essence of lavender. A piece of net, or other thin tissue, is then laid over the article, which is to be dusted over with the colouring matter in the state of fine powder. The colouring matter, passing through the holes of the tissue, attaches itself to the adhesive coating. The tissue is then to be removed, and the article submitted to the action of the fire, taking care, in the case of metals, not to bring them to a red heat, as the colour is more easily fixed thereon than on earthenware, porcelain, &c. When the articles are to be ornamented with figures, &c., they are first coated with the adhesive substance, and covered with net, or other tissue, as before. Stencil plates, made of paper or any other convenient substance, in which the figures have been cut out, are then laid above the tissue, and the colours dusted on; after which, *without taking off the net, paper, &c.*, the goods are subjected to the firing process. Another method of ornamenting such goods, described by the patentee, consists in having the figures cut in blocks similar to woodcuts, which are covered with turpentine varnish, and impressed on the article to be ornamented, which is then dusted with the colour or colours, and fixed as in ordinary cases. Claims—1. The patentee does not claim the application of colour to earthenware, &c., in a state of powder, but its application in a state of powder with net or other tissue intervening. 2. The application of stencil plates, of various figures, as above described. 3. The impressing the figures or ornaments by means of blocks, and then dusting on the colour.

## WESTMINSTER BRIDGE.

*Letter from* Mr. Barry *to the* Speaker, *in answer to a Report of* Messrs Walker and Burges, *upon the proposed alterations.*

Sir—As Messrs. Walker and Burges have thought proper to print and publish a Letter, addressed to you as Chairman of the Commissioners of Westminster Bridge, relative to the suggestions I ventured to offer for the improvement of that bridge, in a Report which I made to the Fine Arts Commissioners, of the 22nd February last, I feel called upon to address to you a few observation, for the information of the Board over which you preside, chiefly with the view of removing several misconstructions which that letter is calculated to occasion.

Westminster Bridge has long been considered extremely inconvenient, as well as unsightly, and, from its proximity to the new Houses of Parliament, is generally felt to have a most injurious effect upon the appearance of that building. As a remedy for these defects, the main objects to be attained are obviously to lower the road-way, to increase the water-way and head-room under the arches, and to reduce the mass of the bridge to the greatest practicable extent. In order to accomplish these objects in the most effectual manner, it appears to me to be necessary to rebuild the bridge; but as the Commissioners were incurring a large outlay in securing and extending the foundations, I recommended in my report above alluded to, that the rebuilding should be confined to the superstructure.

Previously to noticing the several points of Messrs. Walker and Burges' Letter, I would beg to observe, that the suggestions contained in my report were offered merely as hints for the consideration of the Fine Arts Commissioners, and not as mature opinions founded upon a careful practical investigation with reference to execution, in which I stated most distinctly I did not wish to be engaged. I presumed that if the Fine Arts Commissioners deemed those suggestions worthy of attention, they would refer them to the Commissioners of the bridge, by whom they would be duly considered, and, if approved, carried into effect by their own officers.

I now proceed to notice the several observations of Messrs. Walker and Burges upon the suggestions contained in my report. With reference to those upon the relative properties of circular and pointed arches, and to the authorities which they quote in depreciation of the pointed arch as applied to bridge-building, I beg to state, that the hypothesis in which those authorities are said to concur, namely, that a pointed arch requires a greater pressure than a circular arch at the crown, is at direct variance with the opinion of Professor Moseley, of King's College, one of the highest authorities in such matters, who in a letter to me upon the subject states, "that a pointed arch does not necessarily require a great pressure, or indeed any pressure, upon its crown, to prevent it from falling, and that the reasoning upon which an opposite conclusion is founded in Messrs. Walker and Burges' report is erroneous." Both theory and practice confirm me in the opinion which I have advanced in my report, that a pointed arch requires less thickness at the crown than is usually considered necessary for a circular arch. As, however, it might possibly be inferred from the observations of Messrs. Walker and Burges that the arch which I have proposed is not strong enough for its purpose, although they do not attempt to prove that such is the case, I have thought it right to enter into a careful investigation of its properties; from which I am fully convinced, that I have not carried the principle which I have advocated far enough; and that, considering the insignificant span of even the largest of the proposed arches, it would be no great effort of engineering science to reduce the thickness of its crown to nearly one-half of what is proposed by Messrs. Walker and Burges; by which means the lowering of the road-way over the centre arch might be carried to the extent of 6 feet 6 inches, instead of 3 feet 6 inches, even without reducing the clear height of the centre arch as I have proposed; if such reduction were deemed to be an objection of any importance. In this opinion I am confirmed by the examples of numerous stone bridges both in this and other countries, and also by the judgment of several eminent engineers and mathematicians of the present day.

With reference to the loss of water-way, which I stated was occasioned by the haunches or spandrils of the present arches at high water, I ought perhaps to have explained that I referred to such portion only of the water-way as is affected by those obstructions, which might, however, I think, have been inferred: With regard to the removal of these obstructions, I do not agree with Messrs. Walker and Burges in thinking that it would be unproductive of any useful effect upon the "currents and falls;" and I consider the arguments in support of their opinion to be fallacious, inasmuch as they are founded upon the assumed level of high water according to Trinity standard; whereas the present ordinary spring tides, as they must be well aware, rise considerably above that level; on one extraordinary occasion recently as much as 3 feet 6 inches. That some practical good would be effected in giving more head room for craft near to the piers, by raising the springings of the arches according to my suggestion, Messrs. Walker and Burges admit; and I conceive that this advantage alone ought to be a sufficient inducement to remove the present arches and to substitute others of more convenient form; but when it is considered that the opportunity would be thereby afforded of lowering the road-way to nearly double the extent proposed by Messrs. Walker and Burges, without producing the slighest injury to the navigation of the river, the advantage as regards the convenience of the public is so much enhanced, that the propriety of rebuilding the superstructure cannot, I think, be doubted, With respect to my proposition of lowering the centre arch 18 inches, which it appears Messrs. Walker and Burges consider will be "rather a practical evil," as affecting the navigation of the river, it is necessary that I should call your attention to the clear height of the middle openings of some of the bridges above Westminster Bridge, as they have done to those only which are below the bridge. While the clear height of the centre arch of Westminster Bridge is 26 feet above Trinity standard of high water, the centre openings of the modern bridges at Vauxhall and Hammersmith are of the respective heights of 25 feet 4 inches, and 16 feet 1 inch, to say nothing of those of Battersea and Putney Bridges, which are much less, but which I admit are extremely inconvenient. As the largest steamers which pass up the river are those which ply between London Bridge and Richmond, and as their funnels are jointed so as to allow of their of passing even under Putney Bridge, the height of the centre opening of which is only 11 feet 2 inches above high water, it cannot be imagined that the lowering of the centre arch of Westminster Bridge to the extent which I have proposed, can really be an objection of any importance as regards the navigation of the river, while the great object that would be thereby gained by a farther depression of the road-way, to the extent of 18 inches, reducing its inclination to 1 in 40, instead of 1 in 24, as proposed by Messrs. Walker and Burges, would be of the greatest advantage to the traffic over the bridge, as well as to the effect of the new Houses of Parliament when viewed from it; a point which I submit ought not to be disregarded.

Messrs. Walker and Burges state in their letter, as an objection to the form of arch which I have proposed, that the failure of one arch would cause the destruction of all the piers and arches; a consideration which they say is not to be disregarded in a bridge, the piers of which have been so badly founded, that to support them has been a constant expense, and is at this moment a source of considerable anxiety; although they further state, that the works they have in hand, if as successful as hitherto, will render the piers much more secure than they have ever been; they hope, perfectly so. The part of this objection which is founded upon the lateral thrust of arches, will apply with equal force to all arches of a segmental or elliptical form, which are generally adopted in modern bridges, and even to semicircular arches, of the lateral thrust of which I will not affect to suppose Messrs. Walker and Burges to be ignorant, although in the allusion which they make to Labelye's opinion that subject, they leave it to be so inferred. With regard to the other part of the objection, namely, the failure of the foundations, it may surely be assumed that Messrs. Walker and Burges would not have recommended the very serious outlay which is now being incurred in securing them, if they conceived there was any risk whatever of their ultimate failure; but if a possible failure is notwithstanding to be taken into consideration, can a more powerful argument be advanced in favour of a new superstructure, than that the weight upon the piers might thereby be reduced at least one-third?

To Messrs. Walker and Burges' design for a new superstructure I object, principally because it does not accomplish the main objects for which a new fuperstructure is, in my opinion, desirable, namely, the reduction of the mass so the bridge, and the lowering of the road-way to the utmost practicable extent; neither does it afford any improvement whatever in respect of the navigation of the river; the accomplishment of which objects is, in my opinion, of far greater importance, both for the sake of public convenience and architectural effect, than the style of architecture to be adopted.

As to the principles which Messrs. Walker and Burges consider should govern the nature of a design for a bridge over the Thames in London, I entirely disagree with them; I conceive that the height of the opposite shores and buildings upon them should mainly determine the æsthetical character of the design. If, as in Waterloo Bridge, where the shores are high, one being naturally so, and the other raised, and the road-way is level; where the superstructure of a great public building like Somerset House is wholly above the level of the road way; and where the bridge groups with the substructure of such an important building; the character of the design cannot be too bold and massive; but if, as at Westminster, where the shores are low, and the bridge must in consequence group with the superstructure of an extensive work like that of the new Houses of Parliament; and where the parapet must, in consequence of the height required for the centre arch, assume a curved line, which is an element rather of elegance than of boldness, the character of the bridge should be light and graceful.

Upon the taste of Messrs. Walker and Burges' design for a new superstructure in what they term the "Norman style," I forbear to offer any criticisms in detail, as the conditions which should be observed in a bridge are, in my opinion, wholly at variance with the essential characteristics of that style; nor do I consider it worth while to make any remarks upon their observations relative to points of taste, including those especially which refer to harmony and contrast between the bridge, the new Houses of Parliament, and the neighbouring buildings, as they seem to me to furnish their own comment.

In conclusion, I beg to add, that I still remain of the same opinion, as I expressed in my report to the Fine Arts Commission, as to the necessity of a new superstructure to Westminster Bridge upon the principles therein advocated; and as a favourable opportunity is now afforded of carrying into effect that great public improvement, at an outlay, moderate, when compared with its importance, I trust the Commissioners will not be indisposed to take my recommendations upon this subject into their most serious consideration.

I have the honour to be,
Sir,
Your very obedient servant,
CHARLES BARRY.

32, *Great George Street*,
*10th July*, 1843.

The Rt. Hon. CHARLES S. LEFEVRE,
Speaker of the House of Commons,
Chairman of the Commissioners of Westminster Bridge.

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## OPENING OF THE NEW GRAVING DOCK AT WOOLWICH.

THE opening of this stupendous work took place on Monday. 17th July, when this dock was entered for the first time by Her Majesty's frigate *Chichester*, for the purpose of being coppered. &c. Viewed only as a work of mere masonry and architecture, the dock would, in itself, be a most striking object; but when the difficulties required to be surmounted in its construction are considered, it must be acknowledged that the new basin is an object worthy of remark, and a specimen of the perfection to which this particular description of civil engineering is carried in this country. The basin in question is of solid granite, with steps, or what are technically termed altars, on each side, 15 inches to one foot deep, affording facilities for descending to the bottom, and also for props or supports being affixed, thus enabling any vessel, whatever may be her size, to be supported on her keel without injury. The length is 300 feet at the top of the water, 245 feet at the bottom; the width of the basin is 80 feet at top, gradually diminishing as the basin deepens. As it approaches the bottom it presents the appearance of a perfect concave some 26 feet deep. To this basin there are two folding-gates, or locks, extending the whole width of the dock, made of iron and timber doubled, and weighing about 60 tons each; and the perfection with which these gates work, and are adjusted to each other, may be seen in the fact, that though each of them are of the enormous weight of 60 tons, two men, or rather a boy and a man, can move them easily. These gates open to the general basin communicating with the Thames. The dock itself is filled by the river tide, or by a steam-engine working with two 20 horse boilers, which can either fill the dock or withdraw the water in about six hours' time. When the engine is required to empty rhe dock, the water withdrawn from it can either be discharged into the common sewer, or into the basin, which communicates with the Thames The engine is situated some hundred yards from the basin, is by Boulton and Watt, and is a beautiful piece of mechanism. The time it takes to empty the dock varies according to the size of the vessel received in it, a large vessel displacing more water than a smaller one. In the case of the *Chichester*, which appeared to us to be of the size of a 46 gun ship, the time taken was about six hours. There is also upon the top of the engine-house a tank holding some 200 tons of water, available in cases of accident, and in the yard there are also other wells, accessible by pumps, supplying fresh water for the use of the dockyard, the latter wells being perfectly unconnected with the dock itself.

The time occupied in these works has extended over something more than seven years, and the difficulties which the engineer has had to meet and surmount may be judged from the fact that the basin itself is cut through a stratum of peat and another of quicksand, through which percolated a spring which afforded some 800 gallons of water per minute. The whole of these strata were dug through to the depth in some places of 125 feet, and the sub-springing waters were conducted through various channels towards the river. The altars or steps on each side of the dock, which are 24 in number, extend from the top to the bottom of the basin which, viewed from its upper end, presents the appearance of an inverted parabola, and the whole of which is formed of hewn granite masonry; every stone being joggled to its neighbour by pieces of Bangor slate, so that no part of the work can sink in or get out of place; or if it should, then, that all parts of it should sink equally without disturbing their respective bearings and proportions to each other.

The masonry, which is 18 inches in depth, is laid upon concrete seven feet thick. The dock itself is executed from the plans of Mr. Walker, by Messrs. Grissell and Peto, and is calculated to have cost already about 80,000*l.* exclusive of the steam engine.

Taken as a whole, this basin is really a wonderful work, whether we consider it merely as a plain engineering operation, or whether we look at the difficulties which have been encountered successfully. In either case we conceive that great praise is due to Mr. Walker, the engineer, not merely for the general plan of the undertaking, but for the minor details in carrying it out. Taking it for all in all, the work is worthy of the country, it is creditable to those engaged in it, and is calculated to be eminently useful for the public service.—*Times*.

## KYANIZING OF TIMBER.

Sir,—In consequence of one or two erroneous statements which have appeared in your Journal, and also on account of a Report to the Treasurer of the Brighton Suspension Chain Pier Company, upon the preservation of timber from decay by Mr. Prichard, of Shoreham, which report contained many mis-statements, which, if not contradicted, may injure the reputation of a very valuable discovery, you will much oblige me by inserting the following remarks :—

1st. It is asserted that sleepers Kyanized five years ago, and in use at the West India Dock warehouses, have been discovered to decay rapidly.—I would state in reply, that Kyanized sleepers have not been used at any of the West India Dock warehouses, but the Anti-Dry Rot Company did lay down at *their own* station, West India Docks. in 1836, some Scotch fir sleepers prepared with very weak solution, *by way of experiment*, and some of these have shown symptoms of decay.

2ndly. It is asserted that the wooden tanks at the Anti-Dry Rot Company's principal yard are decayed.—The tank referred to was made of unprepared wood, as the maker can testify, and was used as a water cistern, and occasionally held solution; only one or two of the boards showed the slightest symptoms of decay, and that on the *outside* alone. Mr. Prichard, it appears, is not aware that a waterproof tank is capable of containing a solution of corrosive sublimate *without waste;* the solution will not penetrate timber laterally, but only from the extremities, and therefore that it is in no way surprizing that a tank containing a solution of corrosive sublimate should decay *on the outside*.

3rdly. It is asserted by Mr. Prichard, that in Shoreham Harbour there is a wailing piece, the very heart of English oak, Kyanized, and in use only four years, which is like a honeycomb, or network, completely eaten away by the *teredo navalis*, and other seaworms.—The truth of this assertion is denied upon the authority of the annexed Minute of Survey and Report from the Commissioners of Shoreham Harbour.[1]

4thly. Mr. Prichard states that he opposed Kyanizing on the ground that in tropical climates it would be as poisonous as the quicksilver mines of Illyria.—In reply to this statement, I would refer to Messrs. Enderby of Great St. Helen's, who built a ship, many years since, wholly of Kyanized wood. It has been three voyages to the South Seas, the crew have returned each voyage remarkably healthy, and we have now in our possession some of the bilge water, which has been analysed, and found to be considerably more pure than on ordinary voyages,

I am, Sir,
Your obedient servant,
Taswell Thompson, Secretary.

[1] We have not room for the Committee's Report further than the following extract.—Editor.

"Report, that Mr. Thornton, the Harbour Master, had pointed out five pieces of English oak wailing which the sub-committee had inspected and found as sound, in their opinion, as when first put in, and that Mr. Prichard stated that the piece he alluded to as heart of oak was removed from the pier by himself, but he refused to exhibit it."

## REVIEWS.

*Applications of the Electric Fluid to the Useful Arts.* By Mr. Alexander Bain. *With a vindication of his claim* By John Finlaison, Esq., of the National Debt Office. London: Chapman and Hall, 1843.

Controversies on the subject of prior claims to scientific discoveries always involve doubt and pain, but much more so when parties are concerned who have rendered efficient service to the public. Statement is made upon statement, reply upon reply, and the simple truth becomes more difficult to ascertain than before, while personal abuse and personal feelings enter the field to render the contest still more violent and irregular. The main question at issue is, whether Professor Wheatstone or Mr. Bain is the inventor of certain applications of the electro-magnetic power; upon this, several other extraneous issues have been raised, each party accusing the other of piracy, one charging ingratitude and another breach of trust. Under these circumstances a case has been brought forward by Mr. Finlaison, on the part of Mr. Bain, to which we should be inclined to attach considerable weight, if it were not an *exparte* statement, to which we have not yet had Mr. Wheatstone's reply. When it is remembered too that partizanship has displayed itself to a great extent, that the scientific men have enlisted themselves under the banner of Professor Wheatstone, and the natives of Scotland under that of Mr. Bain, the danger of coming to a rash decision is evident. We shall certainly not be so unwise at the present moment. When we recollect the contests between Newton and Liebnitz, Wren and Hooke, Worcester and De Caus, Talbot and Daguerre, Jacobi and Spenser, and so many others, we feel the danger of hazarding a decision. Time is one of the grand elements towards arriving at a correct conclusion in questions of this kind, for it is not until passions are allayed that it is at all prudent to ascend the tribunal of judgment. It must be recollected, too, that there is scarcely an invention or discovery of importance, with regard to which several parties have not been in the field at the same moment, and having at the first blush very strong claims to priority. Under such circumstances, we retreat from the arena; but this we can say, on the present occasion, that whatever may be the result of the present contest, the talent, the invention, and the valuable services of Mr. Alexander Bain, must remain undisputed and unimpaired. His last discovery, it appears to us, cannot be contested, and would alone be sufficient to confer on him high scientific rank. From this part of the pamphlet we shall proceed to give some extracts, with regard to this new and important discovery, which led to the means of dispensing with the galvanic trough, by having recourse to *the earth as a source of permanent voltaic electricity*.

For the purpose of investigating the nature of this phenomenon, Mr. Bain in conjunction with Lieutenant Wright, performed several experiments in the Polytechnic Institution and on the Serpentine River in Hyde Park.

"The first experiment consisted in passing an electric current through the water, by means of a complete circuit of wires laid from one side of the river to the other, with a compound battery of six cells, of about twelve square inches surface on one side of the river, and on the opposite side an electro-magnet of soft iron, with its feeder. On an electric current being established in the wires, it was found that a small portion only reached the electro-magnet; enough, however, to enable it to sustain its own weight. On the circuit being broken, by disconnecting the wires *from the battery*, it was found that the attractive power of the magnet did not entirely cease. The electric current being again transmitted through the wires, the circuit was broken by detaching the wires *from the magnet*, when its attractive power ceased immediately. The experiment was then repeated as at first, and the same result obtained—viz., a very gradual decay of the magnetic power. It is well to observe here, that the feeder was removed from the magnet, and kept from it several minutes; on being again presented to the magnet, it was slightly attracted by it. It was premised that on an electric current being established in one direction, its effects on the magnet might be instantly annihilated by changing the direction of the current; experiment proved this to be the case, and thus pointed out an effectual remedy for the inconvenience, although the cause was still unknown. As it was evident in the foregoing experiment that the greater portion of the electricity was conducted *from one wire to the other by the water*, particular attention was next given to this branch of the subject. A portion of one of the wires forming the circuit was lifted out of the water at several points between the two banks of the river, and the electro-magnet placed in the circuit, when it was found that the current was transmitted by the water from one wire to the other, the greatest portion of the electric current passing from that part of the wires which was nearest the battery. These facts rendered it obvious that water was quite capable of conducting voltaic electricity, provided a sufficient surface of metal was present to convey the current into and ou of the water. Before proceeding to apply this fact, however, the first experiment was repeated, but with a smaller battery.

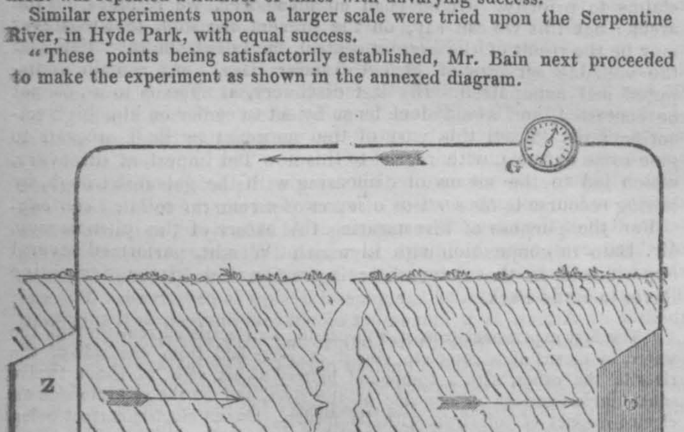
"A copper wire was next laid down on the gravel walk along the north bank of the Serpentine River, from the bridge which separates Hyde Park from Kensington Gardens, to the east end of the river. About three square feet of metallic surface was attached to each end of the wire and put into the river; a galvanometer was put into the circuit at the bridge, and a small Grove's battery at the other extremity of the wire. The electric current passed by the water, and returned by the wire, and with as much power as would have been the case with an ordinary metallic circuit. In this arrangement the magnetic influence ceased the moment the circuit was broken, as it would have done in an entirely dry circuit.

"Reflecting on the foregoing experiment, it occurred to Mr. Bain that the natural moisture of the earth might be a sufficient conductor for the electric current, and with a view to ascertain the correctness of this assumption, a wire was led along a wood-paling extending from the river to a well about a hundred and fifty yards distant; one of the metallic surfaces attached to the wire was put into the river, and the other into the well; the galvanometer was put into the circuit near the river, and the small battery near the well. On completing the circuit, the current passed freely, as in the former experiments, showing that *when sufficient moisture* is present, the earth is a good conductor of voltaic electricity; and that one-half of a voltaic circuit is all that is necessary to be insulated from surrounding conducting matter.

"While reflecting upon these experiments, some few months after they had been performed, Mr. Bain was led to infer, that if a surface of positive metal was attached to one end of a conducting wire, and an equal surface of negative metal to the other end, and the two metallic surfaces put into water, or into the moist earth (the wire being properly insulated from surrounding matter), an electric current of considerable energy would be established in the wire. This proposition was soon tested by an experiment performed in the grounds of Mr. Finlaison (the government calculator), at Algher's House, Loughton, Epping Forest." In a moat distant 150 yards from a pond of water, was placed a plate of about 12 inches surface of positive metal, and in the pond a similar size plate of negative metal, and a galvanometer with a conducting wire connecting the two plates were laid along a gravel walk. "The moment this arrangement was completed, the galvanometer showed that an electric current was passing from the metal in the pond, through the earth to the metal in the moat, returning back again by the wire. The current was of considerable energy, and this experiment was repeated a number of times with unvarying success."

Similar experiments upon a larger scale were tried upon the Serpentine River, in Hyde Park, with equal success.

"These points being satisfactorily established, Mr. Bain next proceeded to make the experiment as shown in the annexed diagram.




A surface of zinc (Z), was buried in the moist earth in Hyde Park, and, at rather more than a mile distance, a copper surface, C, was similarly deposited; the two metals were connected by a wire, suspended on the railing, and on placing a galvanometer, G, in the circuit, an electric current was produced, which passed through the intervening mass of plate from the earth, returning by the wire. In the first experiment, the metallic surfaces being small, the electric current produced was feeble, but on using a larger surface of metal a corresponding increase in the energy of the current was obtained, with which an electrotype process was conducted, and various electro-magnetic experiments performed with uniform success.

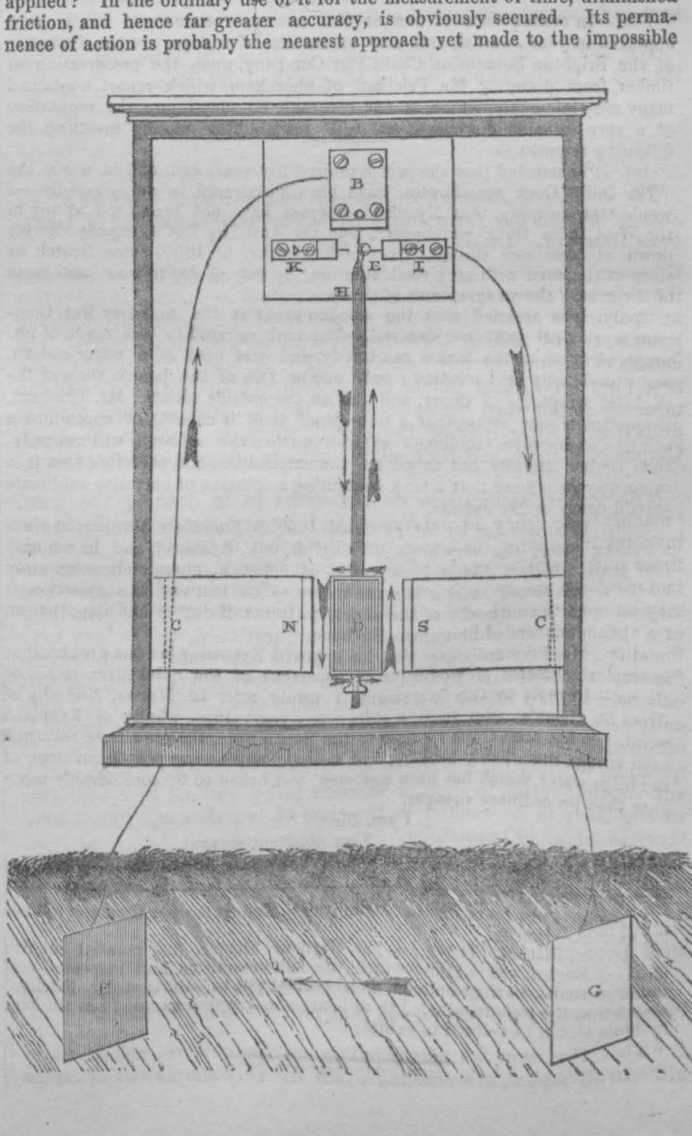
"Subsequent experiments have shown that if two metal plates (a negative and positive) of sufficient surface are sunk in the earth as a battery, and wires led therefrom, electrotype deposition may be effected, and every description of electro-magnetic apparatus worked for any length of time. The most successful results have, however, been obtained by depositing several surfaces of positive metal in the earth connected into a group by wires, from which a conducting wire was led to a series of negative surfaces imilarly disposed at a more remote spot. When considerable power is required, this is the arrangement that should be adopted. It is essential to success, that the earth wherein the plates of metal are deposited should be of a moist nature. A current has, indeed, been obtained in dry soils, but of such small energy as to be of no practical utility. This, however, may have been occasioned by the very small proportion of metallic surface with which the experiment was made.

"Such a source of electricity as the foregoing promises to be most extensively useful in the arts. Among other advantages, its simplicity and cheapness are no small recommendations, while the uniform character of its power is of the utmost importance. A battery of this description, under very disadvantageous circumstances, has produced a power which for upwards of six months has been found unvarying." * * *

"If a copper wire, one-sixth of an inch in thickness be imbedded in a bar of boiling asphaltum and sent along the railway (for its better protection) from London to Liverpool—if two tons weight of zinc plates be immersed in the Mersey at Liverpool, and attached to that end of the wire—and if one ton weight of copper be sunk in the river Thames, and attached to this end of the wire, no rational man can doubt that an electric current would be established of ten times the power necessary to work a telegraph."

"Now, in the voltaic circuit in question, it may be a hard matter to say whether the current flies round the coast by the sea, or whether it penetrates the earth superficially. One thing is, however, certain—the experiment is not likely to be tried at the sole cost of the inventor, and it is humbly conceived that the country, which is to be benefitted by the discovery, should incur the trifling charge of bringing it into use. Supposing, however, the very improbable event, that the current, from some unforeseen cause, could not be passed to the distance of 200 miles, it may still be sent, as far as it will go, in relays, connecting these very easily by means which are well known to every practical electrician."

"The following diagram exhibits Mr. Bain's latest improved pendulum, which is moved by a metallic surface, in the moist earth, of no more than four or five feet. It is, indeed, very necessary in these times to publish it without delay, lest the merit of this invention also should be snatched from him by some one or other of the *faiseurs* of the day. Can any man now foresee the important ends to which this little instrument may hereafter be applied? In the ordinary use of it for the measurement of time, diminished friction, and hence far greater accuracy, is obviously secured. Its permanence of action is probably the nearest approach yet made to the impossible



chimera called the perpetual motion. Mr. Bain intends to apply it also to telegraphic purposes, in which its agency secures him improvements of the last importance, for he can certainly, by its means, discard wheels of any and every description, as well as electro-magnets.

"A A is a mahogany case with a glass front; B is a metal bracket fixed to the back of the case, and to which the pendulum D is suspended. C C are permanent steel magnets fixed to the sides of the case in such a manner as that the pendulum-ball D can vibrate freely between the poles of each magnet. The magnets are so placed as that poles of dissimilar names face each other. E is a small platinum ball affixed to a brass stem, free to move to one side or the other, being fastened to a light spindle carried by the pendulum rod at H. The plate of copper F is deposited in the moist earth, from which a wire leads to the bracket B. The plate of zinc G is likewise deposited in the earth. and its wire leads to the piece of metal I. To the lower end of the suspension-spring of the pendulum is attached a wire coated with silk. It is led down the back of the rod (which is wood), and then coiled longitudinally, in many convolutions, around the edge of the pendulum-ball, in a groove previously made for the purpose. It is then taken up the back of the rod and terminates in the bearings of the spindle at H. The action of the engine is as follows:—A constant and uniform current of electricity would be established, and would pass through the earth, the plates and wires in the direction of the arrows, as long as the platinum ball E rests on the platinum pin projecting from the metal I. But if the pendulum is put in motion, suppose that, at first, it were drawn aside until the ball D should be between the poles of the right-hand magnet, the point H being now farther to the right than the ball E, the latter would fall to the left and rest on the pin K until the pendulum took its vibration to the left, when the ball E would fall to the right, and so on continually, the action being produced by the change of the centre of gravitation at each vibration of the pendulum. This action of the ball E lets on and cuts off the flow of electricity at or near the extreme ends of the pendulum's vibrations, so that the convolving wire of the pendulum-ball is attracted and repelled by the magnets at the proper points of its vibrations, and thus a continual motion is kept up for an indefinite period of time."

We shall endeavour next month to draw the attention of our readers to the ingenious printing telegraph of Mr. Bain.

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*The Inventor's Manual, a familiar and practical Treatise of the Law of Patents for Inventions.* By J. Towne Danson and G. Drysdale Dempsey. London: John Weale.

Several useful works have been published on the law of patents; the object of the present one is to give a clear exposition to inventors and parties interested in patent property, of the modes of obtaining patents, and of making them legally available, without entering into details of a nature merely technical. The authors have brought some new light on various points of the subject; and with regard to the meaning of the word "manufacture," they propose a much simpler definition. After quoting the classifications of Godson, Webster, Carpmael, Rankin, and Holroyd, the authors proceed to observe—

"As these classifications do not assist us in defining the word 'manufacture,' they do not appear to have any practical value to the inventor in defining his claim, or to the public in testing it. For both these purposes the words of the statute, 'any manner of new manufactures,' are amply sufficient, and in every case in which an inventor may have been so ill-advised as to claim a "method,' or a 'principle,' or a 'process,' and his right has been questioned, the judges have found it necessary to bring him back to the expressive word 'manufacture,' and expound to him, that for the invention of that, and that only, will the law afford him the protection of a patent. Or if a difficulty occurs in ascertaining whether or not the security of a patent is attainable, the solution of it is always found to depend on this simple question, whether the invention will give to the public a new, useful, and vendible result, in short, a 'manufacture;' and not by considering its eligibility to be ranked in the class of 'substances,' 'machines,' 'combinations,' or 'principles.'

"It would be easy to show that many of the tedious questions which have perplexed inventors, juries, and counsel, would have been either avoided altogether, or immediately solved, if the words of the statute had been regarded, without reference to the ingenious definitions given of them."

In confirmation of the view here taken, the authors cite various cases decided by the judges, and then proceed to observe—

"That the complex classifications of patentable manufactures hitherto attempted, are resolvable into the very simple one of *things made* and *things improved*, we shall complete this part of the subject, and prove the sufficiency of the word 'manufacture' to cover all beneficial inventions, by selecting a few of the most striking instances from the number of patents which have been granted nominally for *methods, processes, &c.*, and showing, in each case, what was the 'manufacture' produced."

In support of this definition, quotations are given from several cases, selected from a large number, which the authors contend are sufficient to show how the words of the statute, "any manner of new manufactures," may be applied, to limit the extent of every claim of invention.

The authors now proceed to define who may obtain a patent, which we do not think requires much explanation, as the words of the statute, "the true and first inventor," is amply comprehensive. They next explain on what conditions a patent are granted, and then give the various forms necessary for obtaining and securing it, and conclude by describing the use of a patent as property, remedies at law for defending it against infringement, and what is requisite to be done provided the patent is voidable in part, so as to secure a valid title; all of which the authors have explained very briefly, but quite sufficient for the general reader to comprehend, without wading through long legal reports.

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*Ancient and Modern Architecture.* Edited by M. Jules Gailhabaud. London: Firmin Didot & Co. Parts 8, 9, and 10.

This series does not diminish in interest, on the contrary, its character is well maintained. In the numbers now before us are contained several interesting plates. That ancient monument, the Acropolis of Tiryns, is well illustrated, and is a good example of the old Cyclopean citadel. It is a remarkable proof of the extensive progress of architecture at this era, that no less than four hundred towns are known to have been surrounded with stone walls of Cyclopean work, supposed to denote the seats of so many Pelasgic colonies. The Acropolis of Tiryns is a gigantic monument, the walls of which enclose a superficies of 197 feet in length, by 59 in breadth. The external wall is in general 19 feet 9 inches thick, and in some parts 25 feet 3 inches. Its height 42 feet 3 inches. The blocks are in some cases from 10 to 13 feet long, by 4 feet 4 inches thick. The vaults of the galleries are considered as probably the most ancient specimens of the pointed arch in Greece. The church of the Invalides at Paris, affords another illustration; its section shows a triple cupola, and an enormous waste of space between the internal and external roof of the nave. The mosque of Al Mowaiyad, at Cairo, is one of those composite buildings in which the early Arabs indulged, showing a Moorish superstructure upon Greek and Roman columns. The harmony, however, of the general design is preserved. The cathedral of Athens is a monument of not less interest, as a specimen of the Byzantine style, with its lantern, and alabaster windows. It is supposed to belong to the Venetian period. The market of St. Germain will be of interest to our numerous readers engaged in the construction of such works in the provinces; the plates show a view, elevation, ground plan, and the details of the roofs. The market is a parallellogram, with an open court in the interior. The dimensions are 302 feet long by 246 broad. The stalls in the Marché St. Germain are 366 in number. In order to enable our readers to compare, we have brought together the sizes of several markets in France and England.

| Names. | Length. feet. | Breadth. feet. | Area. yards. | Cost. £. |
|---|---|---|---|---|
| St. Germain, Paris | 302 | 246 | 8254 | |
| St. John's, Liverpool | 549 | 135 | 8235 | 40,000 |
| St. Martin's, Paris | 328 | 197 | 7179 | |
| Farringdon, London | 256 | 164 | 4664 | |
| La Vallée, Paris | 204 | 151 | 3422 | |
| North Market. Liverpool | 213 | 135 | 3195 | 13,000 |
| St. James's, Liverpool | .. | .. | 3000 | 14,000 |
| Corn Market, Liverpool | 114 | 60 | 760 | 10,000 |
| Market Hall, Birmingham [1] | 360 | 108 | 4320 | 30,000 |

The Halle au Blé belongs to the same class of subjects, and presents the example of a metallic cupola, 401 feet 6 inches in circumference, and 106 feet 7 inches high.

[1] Six hundred stalls.

*A Map of the Geology, Mineralogy, &c., of the British Isles and part of France.* By J. A KNIPE.

The importance of geology, as a practical science, in connexion with Agriculture and Engineering, is now too well appreciated to require any comment; and the value of any accession to our information on this subject, is equally obvious. It is with these views that we now recommend to the patronage of our readers the production of Mr. Knipe, who has exhibited a degree of labour and research, well worthy of encouragement. He has undertaken to describe the geology, mineralogy, internal communications, harbours and ports of England, and the adjacent countries, together with a part of France, availing himself of the most recent information, and the investigations of the most eminent men of science. Thus each part of the map is laid down from the researches of those geologists who have most distinguished themselves in the examination of particular districts, exhibiting their minute observations, and illustrated by numerous sections. For each part the authorities are given, and an explanatory index is added, referring to the most approved classifications and nomenclature, in English, French and German; in fact, the most minute details are to be found in this map which have not appeared in any other: the size is 5 feet 4 inches by 4 feet 4 inches; we should observe that all the railways and canals are shown, the clination of the strata, heights of mountains, mines, levels, &c.

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*A Series of Diagrams, under the superintendence of the Society for the Diffusion of Useful Knowledge.* Chapman and Hall. Part 7.

This number contains the vertical section of a saw frame, elevation of shears for cutting iron, and the details of an eight day clock. Thus the conductors are realizing a most important desideratum, the publication of a popular series of working drawings of machines, affording instructions at the same time to the workman and draughtsman. We are pleased too to see that a small work on mechanics is to be published to accompany the diagrams. We can fairly say that a series of greater importance to the working man has rarely been published. We should observe that one of the advantages which this work possesses, is, that it will enable classes to be formed in the provincial mechanics' institutions for the study of mechanical drawing, an object for which many working men are chiefly induced to become members of such societies.

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*Photogenic Manipulations.* By GEORGE THOMAS FISHER, JUN. London: George Knight and Sons, 1843.

This is one of the most comprehensive of the many little treatises which have been published on the manipulation of the new arts of design. Coming from the hands of the Messrs. Knight, well known for the attention they have paid to practical science, shows that this tract has been carefully compiled. It takes up the subject in all its branches, including Calotype, Chrysotype, Cyanotype, Photography, Ferrotype, Anthotype, Daguerréotype and Thermography.

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*The British and Foreign Traveller's Guide.* Sherwood & Co.

This little work, which appears to have been compiled with great care, is of the highest value to the traveller, who, indeed, ought not to be without a copy; it gives the times of starting, the fares, and route of all the English and Continental railways, and steam vessels, besides some highly useful and necessary information as to exchanges, and the value of foreign measures and money.

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## NEW CHURCH—STRETFORD NEW ROAD, MANCHESTER.

THIS beautiful church was designed by Messrs. Scott and Moffatt of London. It is built in the early English style of architecture, which prevailed in this country during the reign of Henry III. To give any thing like a perfect description of the building in a limited compass would be impossible; I shall, therefore, content myself with a description of its most prominent features. The church is cruciform in plan, and is composed of nave, ailes, transepts, and apsis or chancel, and a tower at the west end. The dimensions are as follows:—length of nave 65 feet, breadth of transepts 21 feet, and length of chancel 17 feet. The total internal length, including the thickness of the chancel arch, 108 feet. Length of transepts 68 feet, breadth of nave 24 feet, breadth of ailes 11 feet 10 inches, diameter of the pillars 2 feet 2 inches; total internal breadth 52 feet, height of pillars 15 feet 4 inches. There are four arches on each side of the nave, struck from centres at the extremities of the base of an equilateral triangle. The height of the nave, including pillars, arches, and clerestory 40 feet, and the total height up to the ridge of the roof 58 feet. There are no galleries, except a small one at the west end of the nave, the greater portion of which is in the tower; and the front forms a semi-octagon, perforated with small trefoil headed arches, which are supported on small pillars, having base mouldings and capitals: there are stone corbels left on the pillars at the west end for the support of the breast beam of a larger gallery, to extend the whole breadth of the nave and ailes; but it is to be hoped that such a gallery will never be built, as it would totally spoil the internal effect of that end of the church. The body of the church is fitted up with open stalls or benches, and it is sincerely hoped that they will always remain open, for pew doors would effectually spoil the architectural effect of the interior of the church.

In describing the exterior of the church, the tower first claims attention; it is composed of five stages or stories: that on the ground floor forms the west entrance into the church, through a noble and majestic doorway, of good proportions. Its jambs are enriched with small pillars and hollow mouldings; the head consists of a pointed arch, composed of several rich mouldings; the whole being crowned with a good bold label mould. The next stage forms the organ gallery, which is lighted by a lofty lancet window of one light, having on each side a lancet panel, so managed as not to convey the least idea of a blank window, and the whole enriched with small pillars. In the next stage, the walls are perforated with quatrefoils of most beautiful design, and executed in a masterly manner. The next stage forms the ringers' chamber, and being similar to the second, will not need any further description. The fifth stage forms the bell-chamber, and is most beautifully designed; the windows are of two lights under one arch, the head of which is filled in with a foliated circle of four cusps. The corners of the tower are flanked with octagonal turrets, five heights of which are disengaged; and two faces of each turret are again flanked by a buttress rising three stages up the tower. The turrets finally terminate in very richly composed pinnacles, which are also octagonal in plan, and have small detached pillars at the angles supporting small arches, the points of which die under the drip of the pinnacle. Each pinnacle is crowned with a finial, and further enriched by a rib at each angle. The walls of the tower are crowned with an unbroken parapet, the breast resting on small trefoil headed arches, and the water table supported on small corbels. Viewing the tower as a whole, whether by itself or in connexion with the rest of the building, it is certainly one of the finest towers of its class in Great Britain, ancient or modern. Yet it has one fault, whether seen in elevation or perspective, viz., that the pinnacles are considerably too large.

The next thing to be noticed, is the porch on the north side, standing out from the west bay of the north aile; the outer arch is very highly enriched with a variety of beautiful mouldings, and two rows of what is called the dog-toothed ornament; there are three small pillars to each jamb, with base mouldings and enriched capitals. The arch is surrounded with a label, the inner sweep of which is enriched with the dog-tooth ornament, of a much smaller size than those just mentioned. The corners of the porch are flanked with handsome buttresses, terminated with rich canopies. The gable of the porch is surmounted with a beautiful cross; the ceiling consists of stone groined arches, with very beautiful ribs at the angles. The next portion of this side of the church claiming attention, is the north transept, the front of which is perforated with two lancet windows coupled together, the spaces between them and the corner buttresses being filled in with narrow lofty panels, and the heads of both windows and panels form an unbroken series of four arches, crowned with labels, and resting on beautiful small pillars. Above these arches is a wheel window, divided into six compartments, by radiating pillars diverging from the centre. On the point of the gable above this window, is fixed a very handsome cross, enriched with a crown of thorns. The angles of the transept are flanked with buttresses, and crowned with octagonal pinnacles, similar in design to those on the tower. The chancel forms in plan five sides of an octagon, with a buttress at each angle. Connected with the south bay of the chancel is a small but handsome vestry, with an outer door on the south side, and two small trefoil headed windows on the east. There are two inner doors, one opening into the south transept and the other into the chancel. There is nothing in the south side of the church which requires particular description; all the windows, both of ailes and clerestory, are coupled lancets, two to each bay: the chancel windows are of one light. The roofs of the nave, chancel, and transepts are covered with ornamental blue tiles, which have a very good effect. The hips of the chancel roof, and also the ridges of the clerestory and transept roofs, are enriched with a trefoiled leaf ornament. The roofs of the ailes are covered with blue slates. Having thus given a general description of this beautiful church, I shall once more enter it by the south door, and the first object that will present itself to view, is the font on the left hand of the entrance, and at the west end of the south aile. It is so exceedingly rich and beautiful, both in design, material, and execution, as to baffle any written description. On advancing further into the church, and turning to the right down the middle passage, (erroneously called aile,) no one alive to the sense of the beautiful, could avoid being deeply impressed with a lively sense of the architectural fitness of expression, and of the grandeur and beauty by which he would feel himself surrounded. If he looked up to the arches of the nave, he would be struck with the triumphant and dignified boldness of expression by which they are characterized: looking still higher, he would behold the open roof of timber, undisguised by the painter's brush, telling its own simple honest tale. Advancing still further eastward, he arrives in the transepts, where his attention will be caught by a semi-octagon stone pulpit, partly copied from an ancient one still existing in Beaulieu Church, Hants., although inferior to it in several respects. The latter is pure in all its details, but unfortunately this is not so; for instance, there is a row of square quatrefoils round the base of the pulpit, which are decidedly of Tudor character, and which are so very paltry and insignificant, as totally to spoil the whole design. But this is not its only fault: the effect is further injured by the small, shallow, and poverty-stricken foliated spandrils between the arches; and another great and unpardonable fault is the tasteless and unphilosophical application of the four small pillars (on which the pulpit appears to rest) rising out of a bunch of foliage, and appearing as if in the act of falling down. The next object claiming attention, is the groined ceiling over the altar, which is most beautiful in design: the ribs spring from small pillars of stone, placed in the angles of the chancel, and the whole groining has the appearance of being of the same material.

*Manchester.* JAMES HADFIELD.

## STEAM NAVIGATION.

### THE BENTINCK STEAM-SHIP.

This splendid vessel was built for the Peninsular and Oriental Steam Company, at Liverpool, by Mr. Thos. Wilson, and furnished with engines by Messrs. Fawcett and Preston. She is a companion to the *Hindostan*, and destined for the same purpose, to convey the mails between Suez and Calcutta, Madras and Bombay. She is nearly similar in dimensions, model, and power to the *Hindostan*, as follows:—

| | |
|---|---|
| Length of keel | 220 feet |
| Length aloft over all | 250 ,, |
| Beam, within paddle boxes | 39 ,, |
| Depth from spar deck | 31½ ,, |
| Burthen, including spar deck | 2020 ,, |
| Engines (2 of 250) | 500 horse power. |
| Diameter of cylinders | 78½ inches. |
| Stroke | 8 feet. |
| No. of strokes per minute | 15 ,, |

The vessel is rigged in the usual manner of large steam ships, as a three-masted schooner, and her standing rigging is of Smith's patent wire rope. The spar-deck forms a fine and uninterrupted promenade; and on each side the quarter-deck there are broad seats covered with mahogany, resembling ranges of sofas, which also form bins. The state saloon is about 32 feet square, being the whole width of the vessel at the stern, and is approached by a wide corridor, at the end of which a handsome flight of steps leads to the right and left at the top on to the deck; on each side of the corridor are ranges of state cabins, and at the end entering from the stairs, is the ladies' cabin on one side, and stewards' room on the other. The whole replete with every convenience. The decorations were designed and furnished by Mr. Bielefield, of London and Liverpool, those in the state saloon consist of a series of ten interesting views from Affghanistan, beautifully enameled on slate by Steedman; the frames of these are of Bielefield's papier maché, arched at the top; with a lion's head, and alternately a neptune's, with a festoon of flowers over each picture, these are all guilt, and highly relieved; the wood-work or ground is grained satin-wood, and between the pictures are pilasters of slate, enamelled, to imitate vein marble, with enriched gilt caps, a gilt moulding runs all round the saloon, and on the partition there are four Corinthian columns, one on each side of the two sideboards, and one also on each side the rudder-case, where, on the returns, are two finely executed bas-reliefs of "night and morning," executed also in Bielefield's papier maché, after those gems of art by Thorwalsden. The ceiling is simply divided into long panels, with plain mouldings, and the ends of the timbers supported by enriched trusses etched with gold. The prevailing colour of the ceiling is French grey. The mizen-mast is enclosed by a massive fluted Doric column, of wood painted in imitation of veined marble; and a similar but smaller column is placed to enclose an iron one in the center of the entrance to the corridor. The corridor consists of a range of Ionic pilasters, painted in imitation of veined marble, and highly polished, supporting a plain cornice; in the floor, and immediately under a long sky-light is a large well-hole, with mahogany hand-rail and iron ballusters, which lights and ventilates the lower deck, which contains several other state cabins or dormitories.

The ladies' cabin is fitted up with paintings enameled on slate, by Heedman, after Matteau; the subjects are in his usual light and elegant style of garden and love-tending scenery, with a variety of interesting figures pourtraying the tender passion. The frames consist of an enriched bead with centre ornaments; on the pilastars are pendants of flowers in high relief, and an enrichment composed of palms, leaves, and flowers, run round the frieze. The whole of the ornaments are chastely finished in white and gold; and a large looking-glass, judiciously placed, is ornamented with a frame similar to the pictures. The wood-work is grained satin-wood, and the tint of the ceiling is finished French grey. This room has been curtailed of its fine dimensions by a passage having unnecessarily been taken off for an adjoining berth—the partition of which cuts a slice off from the skylight, and ruins the appearance of the ceiling.

The adaptation of Bielefield's papier maché, for the decoration of steam vessels, is now becoming general, and we are happy to bear testimony to its great advantage over every other material for this purpose. The *Hindostan* was enriched with it, though in a very different manner, and has stood the severe test of a hot climate, without any deterioration; one of its superior characteristics being its resistance to vermin—neither worm nor any other insect, heat nor damp, so far as present experience proves—will affect it: and its durability is undoubted. The state panels are also well adapted for decoration, the highly enameled surface brings out the colour of the paintings with surpassing brilliancy, and the rigidity of the substance renders it unliable to warp.

There is a spacious fore-cabin and a lobby, communicating with the principal corridor to the forecastle. On the lower deck, fore and aft, are many other state rooms or dormitories, all fitted up with the greatest attention; and in every part concentration of comfort and convenience seems to be scrupulously studied.

The ship is divided by iron bulk-heads into five compartments, giving her great safety in case of accident; and there are large cisterns for water, hot and cold baths, improved warming apparatus on the worm-tub principle, and every other essential to make her one of the most complete and efficient steam vessels ever produced, and much credit is due to the marine-superintendent, Mr. Shaw, for the very able manner the works have been executed under his vigilant and experienced eye.

TRIAL TRIP.—On the 6th of July the *Bentinck* left the Coburg dock, and proceeded on a trial from Liverpool to Holyhead. There were on board her Commander, Captain Kellock, Mr. Shaw, Mr. Wilson, the builder, Mr. Fawcett, and a few other gentlemen. She started at 6 o'clock, the wind blowing fresh from the westward.

The following is a statement of her progress:—

| GOING. | RETURNING. |
|---|---|
| At 6h. 10m. abreast of the Rock. | At 2h. 16m. abreast of Point Lynas. |
| 6h. 55m. ,, ,, N.W. Buoy. | 5h. 15m. ,, ,, Light Ship. |
| 12h. 15m. ,, ,, Holyhead. | 6h. 4m. ,, ,, Rock Lighthouse. |

Making the trip out and back upwards of 130 nautical miles in 11 hours and 56 minutes. Her speed was occasionally 12 knots, she was found remarkably easy, the engines making 13 to 15½ revolutions per minute.

On the 17th ult. she proceeded to Dublin, from thence to Southampton, and we presume, ere this, has taken her departure for the east.

THE "GREAT BRITAIN" IRON STEAM-SHIP.—This vessel was launched on Wednesday, July 19, in the presence of Prince Albert and many distinguished guests. We have frequently noticed this vessel during her progress, but we will now give a general description to our readers. Burden, 3,500 tons; power, 1,000 horse; length, from figure-head to taffrail, 322 ft.; length of keel, 289 ft.; exrteme width; 150 ft. 6 in.; depth of hold, 32 ft. 6 in. She has four decks: the first or upper deck is flush, 308 ft. in length. The second deck consists of two promenade saloons: the aft or first class is 110 ft. 6 in. by 22 ft., and the forward or second class 67 ft. by 21 ft. 9 in.; they are well lighted and ventilated. The third deck consists of the dining saloons, the grand saloon being 91 ft. 4 in, by 30 ft., and the second class or forward saloon 61 ft. by 21 ft. 9 in. These saloons are all 8 ft. 3 in. high, and surrounded with sleeping rooms, of which there are 26 with one bed, and 113 with two beds, giving 252 berths; an improvement has been introduced which affords, by means of passages, much greater privacy than in any other vessel. The fourth deck is for cargo and coals. Under this deck, in the after-part of the ship, is an iron fresh water tank, and in the fore-part is an air chamber from the boiler to the fore-bulkhead. The forecastle is appropriated to the officers and sailors; mess-rooms, berths, sail-rooms, &c., are underneath. The middle part of the vessel, from the bulkhead of the fore-part to the bulkhead of the after-part, a space of 80 ft., is occupied by the engines, boilers, engineers'-room, and cooking department, which is over the boilers. There are three boilers capable of containing 200 tuns of water, heated by 24 fires, and 4 engines, each of 250 horse power. The cylinders are 88 inches in diameter, which stand in pairs opposite to each other, at an angle of 60° to work the shaft of the propelling gear. The chimney is 8 ft. in diameter and 39 ft. high She has six masts, the highest of which is 74 ft. above deck. She will carry about 1700 square yards of canvas, rigged with Smith's wire-rope. The hull is divided into 4 water-tight bulkheads. She will be propelled by the Archimedian screw, on the plan of the patentee Mr. F, P, Smith. Upwards of 1500 tons of iron have been used in her construction, and that of the engines and boilers. Her draught of water when loaded will be about 16 ft., and her displacement of water about 3,000 tuns The plates of the keel are from ¾ to 1 inch thick, and all the other plates a[re] about ½ in. thick. She is clinker-built, and double rivetted in the long[i]tudinal laps. The ribs are framed of angle iron 6 in. by 3½, and are about 14 in. apart in the middle, gradually increasing to 18 and 21 inches, so that her sides are but 7 inches thick. The boiler platform is of plate-iron, supported upon ten iron keelsons, the centre ones being 3 ft. 3 in. deep. At the engine-room, for the purpose of additional strength, there are 9 intermediate double ribs, and 16 additional transverse ribs. The joists for the support of the several decks are bars of 3-inch angle iron, with a joist bar of 5 inches by ½ inch rivetted on the side. The distance of the joists are about 2½ feet. The deck planks are fastened to the angle iron by screws from below, and firmly secured at each end to the vertical ribs, which affords a support to the sides, in resisting both external and internal pressure, and are supported lengthwise by longitudinal beams and stanchions. To preserve the hull from springing horizontally, there are diagonal tension bars placed between the angle iron bars and deck planks. The wrought-iron mainshaft was manufactured at the Mersey Iron Works, and is the largest ever constructed, weighing about 16 tons. Her pumps will be worked by machinery, and will be capable of throwing off 7000 gallons per minute.

THE ROYAL STEAM YACHT VICTORIA AND ALBERT.—This vessel, the particulars of which we gave in the last June number of the Journal, p. 216, made an experimental trip down the river on the 18th ult.; when off Sheerness, Commander Smith tried the speed of the vessel by the log and found it to be about 12 knots or nearly 15 statute miles per hour, the engines at the time making 18 strokes per minute. Her engines are collectively of 400 horse power; they reflect the highest credit upon Messrs. Maudslays and Field, the eminent engineers, for the superiority and beauty of their workmanship; they are upon the direct action-principle, with double cylinders, as patented by Mr. Joseph Maudslay and Mr. Joshua Field, and described in the Journal. Vol. iii., p. 73, accompanied by engravings. Although this was only the first trial, the engines performed their duty with a smoothness and ease which showed how correctly they had been fitted and applied to each other, and worked so perfectly, that scarcely the least motion could be felt above the engine-room, and not the slightest symptom of tremulous motion. As a whole, they are superior to any they have hitherto made, as with them are combined every really valuable inveniton in that department of the application of steam-power in the royal or mercantile navies of this or any other country. They have brine or change pumps, to prevent the deposit of salt when u ing sea water, refrigerators to cool the water by extracting the heat from it before it goes overboard, expansion gear by which the steam can be used more economically; but the boilers produce an ample quantity for full speed without this resource. The engines are compact and occupy but a very small space in the vessel, compared with their great power to move paddle-wheels 10 feet 6 inches broad and 31 feet diameter, including the feathering boards. The engine-room is surrounded by water-tight bulkheads, and not the least heat is communicated from the furnaces to any other part of the vessel, and their presence is not perceptible in the rooms adjoining them. The vessel is now at Sheerness, and is expected to be completed in the course of the present month, and ready for sea. We hope to be able shortly to give full particulars of both the vessel and her engines.

BRITISH STEAM FRIGATE "PENELOPE."—This extraordinary ship, which has created so much interest in the nautical world, by being cut in half and lengthened 63 feet amidships, and transformed from a sailing to a steam frigate, is now ready. The engines are by Messrs. Seaward and Capel. There are two of them, conjointly being nearly 700 H.P., although the nominal power is only 620 horse, the velocity of the piston being taken at 220 feet per minute. The diameter of the cylinder is 92 inches, and the length of stroke nearly 7 feet. Every part of the engines and boilers is made adequate in capacity and strength for 700 H.P. The engines are made upon what is called the direct-action principle, and upon the same plan as the engines of the *Cyclops*, *Gorgon*, and other steam frigates in her Majesty's steam marine. The condensers are made upon the tubular plan of Mr. Samuel Hall's patent, there are two of them, each containing 7000 tubes, each 6 feet 8 inches long. The cold water is forced through the tubular condensers by four large double-action pumps, worked by rods connected to the air-pump cross-head. The cylinders have four distinct slide-valves, two for the admission of steam, and two for the escape of the steam to the condensers; and the gear for working the slides is so arranged that the admission of steam into the cylinder may be cut off at one-third or three-fourths of the stroke, or at any intermediate portion. The diameter of her paddle-wheels is 31 feet. There are four boilers on the tubular plan, each having five fire places. They are arranged lengthways in the vessel with the fire places (10 of a side) facing the sides of the vessel, so that the two stoke holes or firing places are, one on the starboard and one on the port side of the vessel. In a recess formed between the two foremost boilers is the step for the main mast, which consequently stands nearly in the centre of the engine and boiler room. The chimney is placed at the after end of the two after boilers at a distance of 17 ft. in the clear abaft the main mast. The boilers have each separate safety valves, shut-off valves, feed pipes, and other apparatus, so that any one, two, three, or the whole four can be used at the same time. The total weight of the machinery, including the paddle wheels, the boilers, and the water in the boilers, is stated to be 435 tons: each of the paddle shafts weighs 11 tons, and is 22 inches in diameter. The engines are furnished with a disconnecting apparatus, by means of which the paddle-wheels, one or both, can at any time be disconnected from the engines. The chimney of the boiler is arranged like a telescope funnel in two parts to slide into or shut up one within another. She will have three masts, and be rigged in every other respect as a sailing vessel, with the exception that the yards connected with the mizen mast will be struck, and only hoisted when required to be used. *A Trial of her Speed* took place on Thursday, 29th June, when she went down the river as far as Queenhithe; during her trial the paddle-wheels made 16 revolutions per minute: and her speed is reported to have been between 10 and 11 miles per hour. A second trial took place on the following Saturday, when some of the Lords Commissioners of the Admiralty attended; in trying her speed over the measured mile, which was repeated four times, her maximum rate is reported to be 13·8 miles per hour with the tide, and her minimum speed 10·3 miles per hour. On her return she performed the distance, from Erith to Blackwall, of 11 miles, exactly within the hour, the tide being against her.

THE MERMAID.—On the 20th ult. the *Mermaid*, the vessel of which we have heard such favourable accounts, passed through London Bridge in the morning and reached Woolwich Dockyard half an hour afterwards. We understand that she is to be fitted for foreign service immediately, and the voyage out will afford an excellent opportunity of testing her qualities as a sea boat. The experience already acquired with the *Archimedes*, the *Great Northern*, and the *Napoleon*, a beautiful French corvette, has shewn their superiority over the old and cumbersome paddle-wheel system. The *Mermaid*, we understand, is fitted up with two beautiful engines, with a propeller upon a new principle, and having been repeatedly tried at the measured mile, down the river, has been found to go thirteen miles through the water. She has gone from Sheerness to Blackwall, with tide, in two hours and three-zuarters, the distance being forty-two miles; and the fact of her having beaten, severally, the fastest boats on the river, mounted with paddle-wheels and engines of a superior power, has completely set the question at rest as to the superiority of the stern propeller over the paddle wheels, and over every other description of propeller hitherto tried. The *Archimedes* and *Great Northern* never exceeded 10 miles an hour, unaided by sails. The *Napoleon* is said to have gone 12 m. in the hour, and the French Government are so elated by the success of this vessel, that they have already ordered others to be constructed. *Dimensions of the Mermaid*:—Length of vessel, 130 ft.; breadth, 16 ft 6 in.; depth, 9 ft.; tonnage, 164; power of each engine, 45 horses; weight of engines, boilers, &c., 46 tons; speed, 13 miles. The propeller is of cast-iron, 5 ft. 8 in. diameter, according to Mr. Rennie's plan.—K.

"HERNE" STEAMER.—This fine vessel, built of iron for the Herne Bay Steam Boat Company, by Messrs. Ditchburn & Mair, and furnished with engines by Messrs. Boulton, Watt, & Co., is now running between Blackwall and Margate, and performing remarkably quick passages. The following are particulars of her construction:—Length between perpendiculars, 155 ft. 6 in. breadth of beam, 21 ft. 6 in. and depth in hold; 10 ft. burthen 355 tons. Power two 60-horse engines; cylinders 43½ inches diameter, 3 ft. 6 in. stroke; paddle wheel 18 ft. 6 in. diameter by 11 ft. over, depth of boards 16 in., and 20 in. each. Boiler of the tubular kind. Draft of water, 6 ft. 2 in. Immersed section, 102 ft. The first passage made on the 27th June, was against the tide to Gravesend, the remainder with ebb, the wind light and against. Starting from Brunswick Wharf at 12 h. 3 m., reached Gravesend by 1 h. 27 m., equal 1 h. 24 m., distance 20 miles, equal 14·3 m. per hour. The entire passage was accomplished in 3 h. 50 m., being at the mean rate of 15·7 miles per hour, the engines averaging 29 strokes per minute. The return passage on the 28th, was made with the flood, starting from the bay at 7 h. 38 m. wind N.E., reaching Gravesend at 10 h. 3 m. and Brunswick Whart at 11 h. 14 m., being 3 h. 36 m. for the whole distance, equal 16·7 miles per hour. The tide from Gravesend to the Brunswick Pier was about as much in favour as the run was against; as no trial at the measured mile was made, the average of the above will give nearly the speed in still water, viz. on the 27th, from Brunswich pier to Gravesend against tide, in 84 m. equal 14·3 miles; from Gravesend to Brunswick pier, with tide, in 71 m. equal 15·6 miles speed in still water, with an immersed section of 102 feet. Since then she has frequently performed the distance between the Brunswick pier and Gravesend in 67, 65, and 63 minutes with the tide, and her passages to and from the Bay average 3 hours 45 minutes. The consumption of coal is moderate for a boiler of the tubular construction, being under 5 lb. indicator per horse per hour.

## MISCELLANEA.

BEALE'S PATENT ROTARY ENGINE.—At the Society of Arts, on Wednesday evening, 14th June, Mr. Whishaw (the secretary) read a paper "On the New Rotary Engine," invented by Messrs. I. T. & B. Beale, of East Greenwich, (*Journal*, vol. v. p. 181.) The engine described by Mr. Whishaw is one which is constantly at work on Messrs. Beale's premises, at East Greenwich. It consists of an iron case 14 inches diameter, and 9½ inches in thickness. It was stated that it drives a surface-lathe, weighing 24 tons; a planing machine, 30 tons; two smaller planing machines; three drilling machines; a cog-cutting and key-way cutting machine; twelve large self-acting lathes; 250 feet of shafting; a two-foot circular saw; a shaping machine; a punching and shearing press, capable of punching thirty holes per minute; two screwing machines; a fan, giving 1600 revolutions per minute; and a twelve inch air-pump. The boiler is of the common egg-shaped description; and, for the performance of the above work, 560 lb. of coal is used in ten hours. Mr. Beale has an iron pinnace, fitted with one of his patent engines, same size as the foregoing; she is 38 feet long, 8 ft. 6 in. beam, and 4 ft. deep, drawing, at midships, 2 feet of water, and goes nearly ten miles per hour through the water, although the lines of the boat are greatly at variance to the acquirement of a high velocity, being intended for a man-of-war's pinnace, and having a midship section equal to nine superficial feet under water; she is double bottomed, which forms a condenser to the engine, which is supplied by one of his patent boilers—a cylinder 3 feet in diameter, and in which is placed 296 vertical tubes, half an inch in diameter, and 39 inches long, and the height from ash-pit to dome cover does not exceed 5 feet; she is propelled by four segments of a screw, placed upon an open-ended cylinder, and is 24½ inches in diameter. Several members of the Society of Arts made an experimental trip up the river, and completely proved the superior power of the engine, while the extraordinary facility with which the motion can be reversed, by instantly converting the induction into the eduction pipe and *vice versa*, is of the utmost importance in the traffic of a crowded river.

A NEW GAS LIGHT.—MM. Rouen and Busson, of Paris, are the patentees of a mode of lighting by means of a self-generating gas. The substance employed is coal naphtha, an essence obtained from the distillation of the coal tar, which is one of the products of the distillation of coals for gas-lighting. The mode by which they obtain a more perfect combustion of the naphtha than before reached, is simple. They contrive, by the apparatus of the lamp or burner, that the gas should be projected to some distance in the air before it takes fire, there being, however, within the tube of the burner, a constant flame, which serves the double purpose of igniting the gas projected from the openings of the burner, and by its heat, in decomposing the naphtha with which the lamp is supplied, generating new gas for cont'nued combustion. The gas, being consumed at a short distance from the burner, is thoroughly supplied with air, and this free supply causes perfect combustion, and a brilliant light without smoke; but it may be presumed that, as the gas escapes from the burner before it is in a state of perfect combustion, the smell is more offensive than it would be if consumed at the immediate orifice. MM. Rouen and Busson estimate that the use of this light is attended with an economy of five-sixths as compared with oil, an equal quantity of light being furnished at a sixth of the expense.

Premature Rise of the Nile.—A very remarkable anomaly has been observed this year in the periodical flux of the Nile. From time immemorial the first day of the rise of the Nile has ensued soon after the summer solst ce, and at Cairo the phenomenon has usually taken place some time between the 1st and the 10th of July; this year, however, there was a rise of the river on the night of the 5th of May, consequently two months earlier than usual. This rise continued only four days, after which the water fell, and it still continues falling as it always does until the period of the summer soltice. History affords no example of so early a rise of the river, and only a few instances are recorded of a second rise taking place shortly after the first. One of these instances occurred in the reign of Cleopatra and the other in the year 17:7.—*Cologne Gazette.*

Rise and Fall of the Mediterranean Sea.—A singular phenomenon appeared in the harbour of Valetta on June 2, the water suddenly rising to the height of three feet, overflowing the works of the new dry dock; it almost immediately fell five feet and a half: during this period, a very strong current was running out of the harbour, which the boatmen could scarcely stem. It is supposed this circumstance must have occurred through some earthquake at a remote distance. We hear that at Tripoli in Barbary, several severe shocks have been felt.

Legal Decision regarding Well-Sinking.—In the Court of Exchequer Chamber in Error, on Wednesday, May 19, a judgment of considerable importance was pronounced by Lord Chief Justice Tindal, in the case of "Acton v. Blundell." Within twenty years before the commencement of the action, the plaintiff had sunk a well, and the water which it collected was sufficient to work his mill; but in 1837, the defendant dug a coal-pit three-quarters of a mile distant, which, eventually, drained the well dry, and, therefore, an action was brought to recover compensation. On the trial, the judge told the jury that if the defendant had dug the pit in the manner which was usual in working and winding a mine, he was justified by law in what he had done; and the jury found for the defendant. A bill of exceptions to this charge was presented, which had, subsequently, been argued, but the Court now decided that the summing up was correct. The Court were of opinion that the case should be decided on the principle of the rule which gave to the owner of the soil everything under the surface of it; and that if the plaintiff had suffered loss by the exercise of the defendant's right, it was a loss which was *damnosum non injuriosum*, and for which no action could be maintained. The Court, therefore, unanimously gave judgment for the defendant.

Galvanic Battery.—The battery lately used for the explosion of the Royal George was composed of 20 plates of amalgamated zinc and 40 of cast-iron, on the same principle as Mr. Davidson's battery, with which he exhibits his interesting electro-magnet experiments at the Egyptain-hall, Piccadilly. Two batteries being judged necessary, another was made of the same number of plates and of the same size, that is, 7 by 10 inches square, but using copper instead of iron as had been done in the plate batteries at Dover. On comparing them by the voltameter, the zinc and iron battery was found much more powerful than the zinc and copper battery of the same dimensions; but contrary to expectation, on combining them into one battery, they neutralized each other instead of doubling the power of either, which would have been the case if two voltaic batteries of the same sort had been thus combined.

Electricity of Water.—An interesting and highly important discovery has been made by Professor Faraday during his investigation of the hitherto supposed electricity of steam. At the evening sittings of the Royal Institution, on Friday, the 9th June, a paper was read on the subject, which with some beautiful experiments, convinced his auditory of the fallacy of some important points in the opinions recently held on electrical science. It has been laid down as a principle upon which important theories have been based, that electricity is produced by the evaporation of water into steam, but Mr. F. has shewn that not only has steam nothing to do with it, but that the least vapour in contact with the water prevents the production of the electric fluid, and that water alone, pressed rapidly through a tube, produces the effect hitherto supposed to belong to steam; it being, however, essentially necessary that the water should be pure, even that supplied to our houses for domestic use not answering the purpose; distilled water, however, is now proved to be the most excitable of all electric bodies, while the smallest addition of any extraneous substance will reverse the state of the fluid from negative to positive, and *vice versa*, or destroy it altogether. Its intensity was shewn to be very great, by charging Leyden jars, and drawing sparks from the boiler sufficient to light a jet of hydrogen gas. Mr. Faraday contends that steam, or its action, has no connection with the production of electricity, or thunder and lighting, as there is no water on the surface of the earth sufficiently pure, the evaporation of which could have the effect. The principles propounded in this lecture have excited much interest in the scientific world, particularly among electricians, as the establishment of this theory is so opposed to formerly received opinions, and quite upsets the generally understood *rationale* of engine-boiler explosions.

The Breakwater Lighthouse.—This valuable addition to the public works in our port is now fast approaching to completion. During the past week the third story of the building was completed, so that the oil-room, the store-room, and the living-room are now up. The fourth room, which will be the sleeping appartment, is in a forward state, nearly the whole of it being dry set at the Breakwater Quarries at Oreston. Owing to the great inconvenience experienced from the large number of persons who visited the breakwater and lighthouse, it was found necessary, in order to prevent the constant interruption consequent upon their visits to the latter, to suspend the admittance of the public for the present, but as the several remaining parts of the edifice are put together at the quarries, those persons who may be desirous of inspecting the workmanship may gratify their wish by a visit to the latter place.—*Plymouth Times.*

Dr. Spurgin's Patent Hoisting Machine.—A new machine for raising bricks and other materials to the top of the scaffolding, has just been constructed, and is now in use by Mr. Cubitt, at the houses building at Prince Albert's gate. The hods, baskets, &c. are hooked to a chain ladder, which turns over a wheel at the top of the building; and when emptied, they are sent down by the descending chain. One man is sufficient to work the machinery, so that a vast saving of time and labour is attained. Messrs. Grissell and Peto have also adopted it, and have it in use at the New Houses of Parliament. Dr. Spurgin is the patentee, and M. Journet, a French engineer, has purchased from him the universal licence to carry the invention into operation.

Paris.—The building of the large cellular prison, in the Faubourg St. Antoine, is proceeding with great rapidity. It is in the form of an open fan. All the corridors will arrive at a common centre, fr m which the whole may be inspected. The prison is to contain 1200 cells, and the total expense is estimated at 4,381,000f. It is to be called La Nouvelle Force.

## LIST OF NEW PATENTS.

*(From Messrs. Robertson's List.)*

*Six Months allowed for Enrolment, unless otherwise expressed.*

### SUPPLEMENT TO PATENTS GRANTED IN JUNE.

William Newton, of Chancery-lane, civil engineer, for "*improvements in the preparation of paper designed for bank notes, government documents, bills, cheques, deeds, and other purposes, wherein protection and safety from forgeries or counterfeits are required.*" (A communication.)—Sealed June 10.

Thomas Mitchell, of Dalton, York, dyer, for "*a machine and apparatus for increasing and permanently fastening the face or gloss of all kinds of woollen, worsted, and fancy cloths, by the application of steam alone, without immersing the goods in water.*"—June 15. Two months.

Thomas Richard Guppy, of the Great Western Iron Ship Building and Steam-engine Works, Bristol, civil engineer, for "*improvements in the building of metal ships and other vessels.*"—June 15.

George Edmund Donisthorpe, of Bradford, York, top manufacturer, for "*improvements in combing wool and other fibrous substances.*"—June 15.

John Oliver York, of Upper Coleshill-street, Westminster, engineer, and William Johnson, of Horseley Iron Works, Staffordshire, ironmaster, for "*improvements in paving or covering roads, streets, and other ways or surfaces.*"—June 15.

Samuel Mason, of Northampton, merchant, and Caleb Bedels, of Leicester, manufacturer, for "*improvements in the manufacture of boots, shoes, slippers, overalls, and clogs, and improvements in machinery or apparatus used in such manufacture, and in the preparation of materials for the said manufacture.*"—June 15.

William Edward Newton, of Chancery-lane, civil engineer, for "*improvements in apparatus for propelling vessels.*"—June 15.

George Robins Booth, of Hanley, Stafford, manufacturer and chemist, for "*an improved mode of applying heat from various combustibles to manufacturing and other useful purposes.*"—June 15.

Thomas Oldham, of Manchester, manufacturer, for "*an improved mode of manufacturing bonnets and hats.*—June 15.

Oglethorp Wakelin Barratt, of Birmingham, experimental chemist, for "*improvements in gilding, plating, and coating various metallic surfaces,*"—June 15.

Lemuel Wellman Wright, of Gusford Cottage, North Wales, engineer, for "*improvements in machinery or apparatus for bleaching various fibrous substances, and is also in possession of an invention of improvements in machinery or apparatus for converting or manufacturing the same into paper.* (A communication).—June 15.

### GRANTED IN ENGLAND FROM JUNE 22, TO JULY 26, 1843.

Louis Le Page, of 72 Lombard-street, for "*an improved method or methods for preventing accidents on railways.* (A communication.)—June 22.

William Wylam, of Newcastle-upon-Tyne, merchant, for "*improvement in the manufacture or preparation of fuel.*—June 22.

Samuel Ellis, of Salford, Leicester, engineer, for "*improvements in weighing machines, and in turn tables to be used on or in connexion with railways, and in weighing machines to be used in other places.*"—June 22.

Samuel Eccles, of Hulme, Lancaster, machinist, and Matthew Curtis, of Chorlton-upon-Medlock, machinist, for "*improvements in looms for weaving.*"—June 22.

Mose Poole, of Lincoln's-inn, gentleman, for "*improvements in collars for horses and other animals.* (A communication.)—June 23.

Nicholas Troughton, of Swansea, Glamorgan, gentleman, for "*improvements in dressing ores requiring washing.*"—June 23.

William Needham, of Birmingham, gunsmith, for "*improvements in fire-arms.*"—June 24.

John Duncan, of 72, Lombard-street, gentleman, for "*improvements in the casting and construction of types for printing.*" (A communication.)—June 26.

Charles Townsend Christian, of Saint Martin's-place, Saint Martin's-lane, East India army agent, for "*improvements in the construction of steam-engines.* (A communication.)—June 27.

Richard Waller, of Bradford, York, coach-builder, for "*improvements in locomotive carriages, and in steam boilers and engines.*"—June 27.

John Thomas Betts, of Battersea, gentleman, for "*improvements in covering and stopping the tops of boxes, jars, pots, and other vessels.*" (A communication.)—June 27.

Edward Johnson, of Nelson-square, Blackfriars-road, Surrey, surgeon, for "*improvements in apparatus for bathing.*"—June 27.

Alexander Parkes, of Birmingham, artist, for "*improvements in preparing solutions of certain vegetable and animal matters, applicable to preserving wood and other substances, and for other uses.*—June 27.

Charles Kurtz, of Liverpool, manufacturing chemist, for "*an improved lamp, for the combustion of naphtha, turpentine, and other resinous oils.*"—June 30.

Charles Tetley, of Bradford, gentleman, for "*an improvement or improvements in the construction of boilers, otherwise generators, for producing steam.*"—June 30.

James Lancaster Lucena, of Garden-court, Middle Temple, Barrister-at-law, for "*improvements in steam engines, and in machinery for propelling vessels, which improvements are applicable to other purposes, being an extension of a patent for the term of five years granted by his late Majesty King George the Fourth to Alexander Galloway, of King-street, Southwark, engineer.*"—July 1.

James John Green, of Woolwich, surgeon, for "*improvements in apparatus for securing, or fixing, standing, rigging and chains, and other tackle.*"—July 1.

Charles Phillips, of Chipping Norton, Oxford, engineer, for "*improvements in apparatus or machinery for cutting corn, grass, and such like standing or growing crops, and in apparatus or machinery for cutting vegetable substances as food for cattle.*"—July 3.

Thomas Wedlake, of Hornchurch, Essex, machinist, for "*improvements in machinery for making hay, which improvements are applicable to other agricultural purposes.*"—July 3.

James Verity, of Leicester-street, Regent-street, boot and shoemaker, for "*improvements in the heels and soles of boots and shoes.*"—July 3.

James Hartley, Wear Glass Works, Sunderland, glass manufacturer, for "*improvement in the manufacture of glass.*—July 3.

James Boydell, junr., of Oak Farm Works, Stafford, iron master, for "*improvements in the manufacture of metallic roofs and joists, and improvements in joining sheets or plates of metal, for various purposes.*"—July 6.

Florimond Delcroix, jun., of Norfolk-street, Strand, merchant, for "*improvements in furnaces for locomotive and other engines, and in the apparatus used for regulating the escape of steam, and the passage of air in chimneys of furnaces.* (A communication.)—July 6.

James Neville, of Walworth, civil engineer, for "*improvements in the form and manufacture of horse shoes.*"—July 6.

John Wright and Richard Wright, both of Richmond, York, boot and shoe makers, for "*improvements in boots and shoes, and other like covering for the feet.*"—July 6.

Joseph Cooke Grant, of Stamford, Lincoln, ironmonger, for "*improvements in the construction of harrows.*"—July 6.

John Woodhouse Day, of Well Field, Durham Colliery, and land agent, for "*improvements in apparatus to facilitate the loading of vessels with coal, culm, or cinders.*—July 6.

George John Newberry, of King William-street, London, artist, for "*improvements in the manufacture and construction of window blinds, screens, shutters, and other similar articles, parts of which improvements are applicable to other purposes.*"—July 6.

Henry Clar... Ash, of Birmingham, manufacturer, for "*improvements in the construction of teapots.*"—July 6.

James Booth, of Liverpool, clerk, and doctor of laws, for "*improvements in the means of converting rectilinear into rotary motion, and of converting rotary into rectilinear motion.*"—July 6.

Thomas Masters, of Upper Charlotte-street, St. Pancras, confectioner, for "*an improved freezing, cooling, churning, and ice-preserving apparatus, the parts of which may be used separately or in combination.*"—July 6.

James Joseph Brunet, of Limehouse, esquire, for "*improvements in propelling, parts of which improvements have been communicated to him by a foreigner residing abroad.*"—July 6.

George Parsons, of West Lambrook, Somerset, gentleman, for "*a portable roof for various agricultural, and for other purposes.*"—July 7.

George Parsons, of West Lambrook, Somerset, gentleman, and Richard Clyburn, of Uley, Gloucester, engineer, for "*improvements in machinery for beating, cleansing, and crushing various animal and vegetable materials or substances.*"—July 10.

Jacob Samuda, of Southwark Iron-works, engineer, for "*improvements in the construction of steam-engines, particularly applicable to the purposes of steam navigation.*"—July 10.

John Laird, of Birkenhead, Cheshire, ship-builder, for "*improvements in the construction of steam and other vessels.*"—July 10.

William Edward Newton, of Chancery-lane, civil engineer, for "*an improved agricultural machine, or implement for ploughing, harrowing, or tilling land.*" (A communication.)—July 13.

Richard Laming, Radley's Hotel, New Bridge-street, Blackfriars, London, gentleman, for "*improvements in the purification and application of ammonia, to obtain certain chemical products.*"—July 13.

Joseph Maudslay, of Lambeth, engineer, for "*improvements in machinery used for propelling vessels by steam power.*"—July 13.

George King Sculthorpe, of Frederick's cottages, Coleharbour-lane, gentleman, for "*an improved method of fastening and securing bedsteads.*"—July 13.

Henry Pinkus, of No. 1, Duke-street, Portland-place, esquire, for "*improvements in the methods of applying motive power in combination with apparatus and machinery, to certain purposes in propelling, and applicable to railways, to ships, or other vessels afloat.*"—July 13.

Stephen Geary, of Hamilton-place, King's-cross, architect and civil engineer, for "*improvements in machinery or apparatus for clearing, cleansing, watering, or wholly or partially covering with sand, or other materials, roads, streets, or ways, and which machinery is also applicable to other similar purposes.*"—July 13.

William Midworth, of Mansfield, Nottingham, brass founder, for "*improvements in the construction of what are commonly called street guard plates for public water services, and in the mode of constructing the stop-valves, stoppers, or stop-cocks, used therein, and which stop-valves, stoppers, or stop-cocks are also applicable to various other purposes, where the flow of water, or other liquids, is required to be regulated or suspended.*"—June 13.

Henry Smith, of Birmingham, Warwick, for "*improvements in apparatus for fastening doors, and in apparatus for giving action to alarums.*"—July 13.

William Hutchison, of Ivy Bridge-lane, Strand, marble and stone merchant, for "*improvements in machinery for cutting marble and other stones.*" July 13.

James Neville, of Walworth, civil engineer, for "*improvements in obtaining power by means of gases, applicable to working machinery.*"—July 13.

Ann Wise, of Saville-row, Burlington-gardens, Parisian corset-maker, for "*improvements in the construction of stays and umbilical belts.*"—July 13.

Robert Ransome, of Ipswich, ironfounder, Charles May, of the same place, also ironfounder, Arthur Biddell, of Playford, Suffolk, farmer, and William Worby, of Ipswich, foreman to Messrs. T. R. and A. Ransome, for "*improvements in machinery and apparatus used for ploughing and scarifying land, and for raking, and for improvements in machinery and apparatus used for thrashing, cutting, and grinding for agricultural purposes, and for improvements in the construction of whipple-trees.*"—July 15.

James Overend, of Liverpool, gentleman, for "*improvements in printing fabrics with metallic matters, and finishing silks and other fabrics.*"—July 15.

William Garnett Taylor, of Halliwell, Lancaster, cotton spinner, "*for improvements in machinery for spinning cotton and other fibrous substances, and in preparing and dressing yarn for weaving.*"—July 15.

James Gallop Beater, of St. Clement's-place, Worcester, tailor, for "*improvements in the fastenings for trouser-straps, and in fastenings for wearing apparel generally.*—July 20.

Henry Austin, of Hatton-garden, civil engineer, for "*improvements in the construction of water-closets.*"—July 20.

Charles Bertram, of the Borough of Newcastle-upon-Tyne, esquire, for "*an improved mastic or cement, which may be also employed as an artificial stone, and for coating metals and other substances.*"—July 20.

Joseph Harvey, of James-street, Buckingham-gate, gentleman, for "*improvements in the construction of two-wheeled carriages.*"—July 20.

William Daniell, of Abercarne, near Newport, Monmouth, tinplate manufacturer, for "*improvements in rolling iron into plates or sheets.*"—July 22.

James Nasmyth, of Manchester, engineer, for "*improvements in machinery or apparatus for driving piles, part or parts of which improvements are applicable also to forging or stamping metals and other substances.*"—July 22.

Joseph Daniel Davidge, of Greville-street, Hatton Garden, machinist, for "*improvements in manufacturing certain materials as substitutes for whalebone applicable to various useful purposes, and in the machinery for effecting the same.*"—July 24.

David Napier, of York-road, Lambeth, engineer, for "*improvements applicable to boilers or apparatus for generating steam.*"—July 25.

Frederic Lewis Westenholz, of 151, Regent-street, merchant, for "*a double-centred steam-engine.*"—July 25.

Samuel Faulkner, of Manchester, cotton-spinner, for "*improvements in the machinery or apparatus for carding cotton and other fibrous substances.*"—July 25.

Edward Eyre, of Poole's Hotel, London, gentleman, for "*improvements in railways, and in the machinery or apparatus employed thereon.*"—(A communication.)—July 26.

William Crofton Moat, of 28, Upper Berkeley-street, Marylebone, surgeon, for "*a method of obtaining aerial locomotion.*"—July 26.